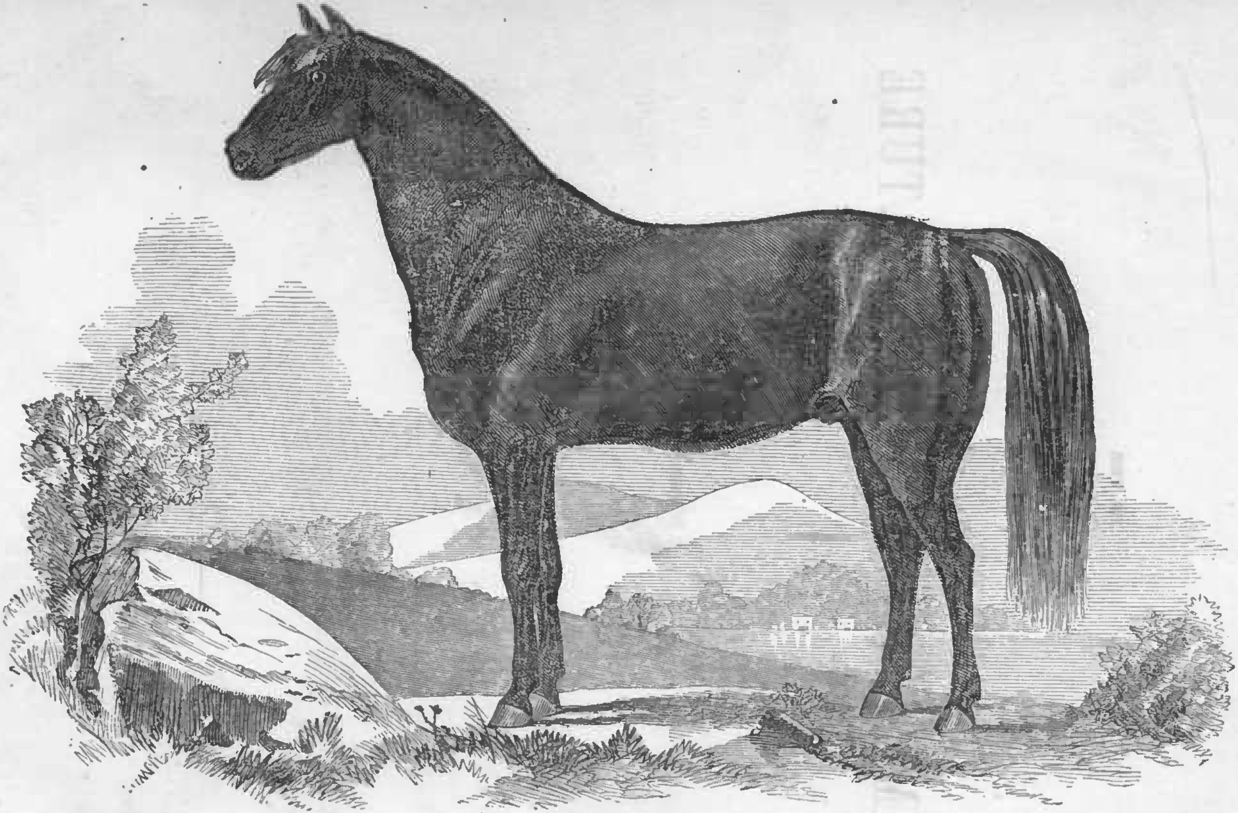

"GENERAL KNOX."

Property of T. S. *Lang, No. Vassalboro, Me.; very dark brown,* 10 *years old,* 15½ *hands high, weighs* 1050 *pounds. Sire, Sherman Black Hawk, or North Horse—Dam of Hamiltonian blood, Grand Dam by Young Hamilton—he, by Bishop's Hamiltonian—he, by imported Messenger.*

REPORT

OF THE

COMMISSIONER OF AGRICULTURE

FOR

THE YEAR 1864.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1865.

REPORT

OF THE

COMMISSIONER OF AGRICULTURE.

WASHINGTON, D. C., *December* 1, 1864.

SIR: I have the honor to submit to you my third annual report, and it is with a feeling of just pride in the success of the department, aided by the co-operation of the intelligent farmers of the country, that I can make so favorable a showing of its operations and of the agriculture of the country.

Notwithstanding the devastation caused by the terrible war in which we are engaged, the diminution of the laboring force of the country by repeated calls for able-bodied men, the great and continued demand for money and means to suppress the rebellion, and the constant claims and interruptions to which portions of our country have been subjected, our agriculture during the past year has been prosperous and progressing.

A favorable seed time and a glorious harvest have been vouchsafed to us, and the farmers of the country, with somewhat less than an average in amount, have stored in value, owing to its superior quality, a larger paying crop than was ever before gathered, from which, it is probable, there will be a surplus for exportation equal to that of former years.

A brief review of the condition of the crops during the past year will not be improper at this time. The winter of 1863–'64, was very severe, and in many parts of the country destructive to crops, animals and fruit trees to such an extent as to create a fear in the early spring that the reduction of the crop of fall-sown wheat would be very serious. A favorable spring, however, and an unusually large breadth of spring-sown grain, went far to make up the deficiency.

The wheat crop of 1864 is less than that of last year by 18,708,213 bushels. Its quality, however, is generally superior, and on this account it will meet with a better demand in the English market, for the wheats of Northern Europe have not been harvested in good condition, on account of wet weather. Although the crop is less than that of last year, yet the greater abundance of corn and buckwheat will lead to a lessened home consumption, so that the export demand can be met.

Rye.—This crop is less by 909,807 bushels than last year's—a difference too small to affect the market value.

Barley.—This crop is also less by 750,827 bushels, but it is too small a reduction for further notice.

Oats.—There is an increase in the oat crop over last year's of 2,889,489 bushels.

Corn.—The long and severe drought of the past summer occasioned great anxiety for the corn crop, whilst the rains in August came too late in some localities to materially benefit it, and in others some of the fields were too far injured to recover, yet, generally, the showers were in time to benefit the crop very much. Compared with last year, the crop of 1864 is 78,613,444 bushels greater, and 55,644,902 bushels less than the crop of 1862. But it is certain that the home demand upon it will be far less than on that of 1862. There will be nearly two millions of hogs less, and a greatly decreased number of cattle to fatten; less farm stock to keep over winter, and a still larger saving effected by a diminished distillation. These lessened home demands will render the ability to meet an export demand in 1865 fully equal to that of 1863.

Tobacco.—There is a large decrease in this crop. In 1863 it was 267,267,920 lbs, and this year but 197,468,229 lbs.—a difference of 69,799,691 lbs. The chief reduction in the crop of 1864 is to be found in the States of Kentucky, Missouri, and Maryland. The condition of their labor, and the unfavorable season for planting out, are the causes of this reduced production.

The scarcity of labor in other States, and the fear that the internal duties would cause a decreased home consumption of the commodity, induced a lessened cultivation.

Buckwheat.—This crop has increased 2,994,085 bushels over that of 1863, and is equal to that of 1862.

Potatoes.—At one time it was feared this crop would be almost a failure, but the rains of August and September were favorable to it, especially in the northeastern States. The northwestern had rains in July, but the latter part of the season was unfavorable. The crop is 3,903,782 bushels less than that of 1863.

Hay.—Although this crop is 1,620,096 tons less than that of last year, yet its superior quality will fully compensate for its decrease in weight. It was harvested in the best condition.

Flax-seed.—Most of the States show a large increase, ranging from one-tenth to four-tenths. The increase in lint is not so great, but is much in advance of the crop of 1863.

Sorghum.—In most of the western States where this cane is grown to a large extent, and sirup has been made in considerable quantities, there is no great increase above 1862, except in Illinois, where it is two and a quarter tenths.

Cotton.—The returns from counties in which this product is grown are not many, but, compared with 1862, they show a considerable increase, ranging from one to five-tenths. In Illinois it is four-tenths or forty per cent.

Root crops.—There is a large decrease in these in nearly all of the States, which I regret to see. Turnips, rutabagas or Swedes, mangold-wurzels, and other roots are most valuable articles of food, and if cultivated more generally would, to a great extent, take the place of corn in winter feeding of stock.

Fruit.—In the eastern and middle States the yield of apples, peaches and

grapes has been very good, but in the western States the destruction of the trees by the intense cold has caused a diminution of fruit that will be felt for years.

Horses.—The great demand for horses and mules to supply the wants of the army has enhanced their price, and drawn away a great number from the farming operations; improved implements and machinery, however, and the wide extension of railways and of other means of easy communication go far to offset this.

The very important subject of breeding horses for cavalry uses is attracting attention, and is worthy of encouragement.

Cattle.—The large amount of beef consumed by the army, the scarcity of corn and fodder the last winter, and the drought of the past summer, will reduce to a considerable extent the number of cattle to be fattened this year.

As the supply of cattle is evidently becoming inadequate to meet the wants of the army, and the people of the country, increased as they are by the vast influx of immigrants, who are for the first year, at least, of their residence, non-producers, it seems to me to be the duty of the farmers to raise more cattle, and not to slaughter their calves, as is the too common practice.

The products of the dairy have been in great demand, and but for the drought would have very largely exceeded any previous year. The introduction of the best English breeds of cattle, and our own improved breeding, have greatly increased the value of our stock.

The pleuro-pneumonia has again shown itself in New England, but strenuous efforts are being made to prevent its spread, which it is hoped will prove successful.

Sheep.—The increased demand for wool has induced a corresponding increase in sheep raising, one of the most important and profitable branches of farming, and it is to be hoped that before many years have passed we shall not only cease to be importers of wool, but exporters to a large extent.

The last winter was a severe one for sheep in the west, on account of the intense cold and want of shelter, and in the east from the very poor hay, which farmers were compelled to feed, and from diseases of various kinds.

There is some danger always to be apprehended by the introduction of contagious diseases from abroad. The small-pox or sheep-pox has prevailed to a great extent among the English flocks, and is a most destructive and fatal plague. As communication between this country and Great Britain is now so speedy, too much care cannot be exercised by those importing, and by the custom-house officers, to guard against its introduction here.

Swine.—The number of fattening hogs is much below an average, probably one-third; this is mainly due to the short crop of corn last fall and winter.

The hog cholera though, still prevailing in some places, has not been so destructive as usual in the west.

The plan by which our knowledge of agricultural products is obtained, and the basis on which these facts and the figures below are given, are arranged in the statistical division. On account of their importance, I venture to give some-

what in detail the arrangement. No part of the duties of this department is more important or more laborious than that of collecting, compiling, and publishing the statistics of the agriculture of the country. This, after two years of experience, has been systematized with thorough and comprehensive order, under four heads:

1st. The collection of statistics pertaining to the annual crops.

2d. The preparation of tables of the exports of domestic produce and their value. The receipts, shipments, and prices of this produce at the cities chiefly trading in it.

3d. The collection of information on general and important topics bearing on agricultural production.

4th. The preparation of the monthly and bi-monthly reports issued by the department.

Besides these special duties, there is a general one in the gradual accumulation of statistics on all topics connected with agriculture, to be used as the special objects may require:

1st. The collection of statistics pertaining to the annual crops.

Under this head two things are to be noted—the means used to procure them and the results obtained through their agency.

The means used are *circulars*, addressed to correspondents in nearly every ounty in each State. They contain inquiries relative to the crops, as the season and its character require. The answers are given in tenths, increase or decrease, compared with a previous year. These correspondents have from three to five assistants in each county, to whom circulars are sent, who make their returns to the chief correspondent. This plan has been suggested by experience, which has most clearly shown that reliable information cannot be obtained by casual inquiries, or through casual correspondents.

The several crops must be made known in all stages of growth from their sowing or planting until harvested, and the correspondents must be persons who have the means of learning their condition at all times, and whose judgments are strengthened by this constant exercise, and whose zeal is increased by the interest which they take in their voluntary aid, from the knowledge of the utility of the information they impart. Through the knowledge thus obtained this division becomes aware of the amount of each crop sown or planted, its growing condition during the season, the extent and nature of the injuries received by it, and the amount harvested compared with the previous or other years. These reports are carefully compared, and from them the amount in bushels, pounds, or tons estimated.

The results, both as to their correctness and utility, have been fully tested. The plan adopted could not have been more severely tried than during the time it has been used, for to the difficulties we have had to encounter, from the disturbances occasioned by war, there has been added, last year, the greatest destruction of the fall crops, by premature frosts, ever known to the country, and this year by extensive injuries from severe drought.

The information obtained embraces the amount of each of the principal crops, the yield per acre of each, the number of acres in cultivation in each crop, the average price of each in each State, the value of each crop according to this price, &c. For the purpose of exhibiting more fully the character of the information given in these estimates, the following general summary of amount, prices and value of the principal crops is here given, excluding California, Oregon, and Kentucky, from which sufficient returns had not been received in 1862 and 1863, but including Kentucky in 1864:

General summary of the crops of 1862.

Names of products.	Amount.	Price.	Value.
Indian corn .... bushels..	533,387,230	$0 34 8/10	$185,618,756
Wheat .... do....	177,957,172	93 7/10	166,745,870
Rye .... do....	20,577,971	70	14,404,579
Oats .... do....	169,681,113	36 6/10	62,103,287
Barley .... do....	12,385,647	86	10,651,656
Buckwheat .... do....	18,763,756	56½	10,601,522
Potatoes .... do....	112,577,482	39 7/10	44,693,260
Hay .... tons...	21,110,370	9 20	194,215,404
Tobacco .... pounds..	136,751,746	11 9/10	16,273,457
			705,307,791

General summary of the crops of 1863.

Names of products.	Amount.	Price.	Value.
Indian corn .... bushels..	397,839,212	$0 69 8/10	$278,089,609
Wheat .... do....	173,677,928	1 14	197,992,837
Rye .... do....	19,989,335	1 03	20,589,015
Oats .... do....	170,129,864	62 3/10	105,990,905
Barley .... do....	12,158,895	1 11	13,496,373
Buckwheat .... do....	15,786,122	80⅛	12,660,469
Potatoes .... do....	98,965,198	55 6/10	55,024,650
Hay .... tons...	18,346,730	13 50	247,680,855
Tobacco .... pounds..	163,353,082	14 9/10	24,239,609
			955,764,322

General summary of the crops of 1864.

Names of products.	Amount.
Indian corn .... bushels..	530,581,403
Wheat .... do....	160,695,823
Rye .... do....	19,872,975
Oats .... do....	176,690,064
Barley .... do....	10,716,328
Buckwheat .... do....	18,700,540
Potatoes .... do....	96,256,888
Hay .... tons...	18,116,751
Tobacco .... pounds..	197,468,229

The last table cannot be completed until returns are received of the prices in November in the several counties of each State. The prices given for 1862 and 1863 were obtained from them; their average for each State made and multiplied into the amount of the crop for each State. This mode of estimating the value of the leading crops is the only one yet adopted that approximates to the actual value.

These tables are both interesting and highly instructive, for they show the increased value given to the crops from a scarcity or failure in any one, from the war demand and from the depreciation of the currency. And surely information of the crops and their values, thus collected and arranged in tables by this division of the Department of Agriculture, cannot but aid the interests of the community in all its departments of business.

The prices for November, 1864, have not yet been ascertained, and hence the table for that year is incomplete. But it may be taken for granted that when ascertained they will not give as great a proportional value as the prices of November, 1863, adding to them the increased rate in prices occasioned by the advance in gold, and the increased amount of the crops of 1864; for the reason that the prices in Great Britain, which give value so largely to our agricultural products, were much less in 1864 than in 1863, and to the extent of their reduction will be the proportional value of the crop of 1864. The value of the crops named for 1864 will range between $1,500,000,000 and $1,750,000,000. But it is evident that the value will be very favorable to the farmer, who, by availing himself of his ability to live on his own resources, can avoid, to a great extent, the increased living expenses that other classes are subject to, from the greatly increased prices of clothing, rents, fuel, and food.

Again. By the same plan, and through the aid of the same correspondents, the increase or decrease of the farm stock is ascertained. In January, 1864, the first estimates were made, comparing the number at that time with those returned by the census of 1860.

This comparison is as follows:

	Horses.	Mules.	Cattle & Oxen.
1859	4, 199, 141	301, 609	7, 941, 148
1864	4, 049, 142	280, 847	7, 965, 439

	Cows.	Sheep.	Hogs.
1859	5, 726, 964	15, 104, 272	17, 060, 035
1864	6, 066, 748	24, 346, 391	16, 140, 712

During the summer and fall the increase or decrease in the amount of butter and cheese is ascertained in the same manner, and in the fall the number of fattening hogs and cattle.

These estimates are also published in the reports of this department, and by the information thus made public the commerce in farm stock and their products is regulated, and the farmer's attention is timely directed to a decrease or overproduction of any one of them. Heretofore an evil in our agriculture, was overproduction, occasioned by a casual demand from abroad; but the tables of this

department, like the regulator of the steam-engine, will do much to prevent either a deficiency or its opposite.

2. The reference just made to the influence which foreign markets and exports have on the value of our agricultural products shows the importance of the preparation and publication of the tables of exports, stated as the *second* special duty of this division. Their purpose is to place before the farmer all the elements of demand for the products of his labor, that he may give it such direction as these elements point to.

3. The *third* special duty of this division is the collection of information on such subjects as bear on agricultural production, and are of a general nature the facts of which can be best reached through the extensive system of correspondence employed by the department.

As an illustration of the nature of such subjects, I refer to the article published in the report of November, 1863, on the system of our agriculture, as to the use of manures and the depth of ploughing, considered as a fertilizer. It embraced the use of clover as a manure, and of lime, plaster, and barn-yard manure, as used in the various portions of the loyal States. Another article is that published in the September and October report of 1864, on the relative advantages of drilling wheat, and sowing it broadcast, as shown by the correspondence of this division, from the effects of the cold of the past winter.

The purpose of such articles is to keep before the farmer the necessary means of sustaining the soil in the production of our immense crops, and to correct errors in the modes of husbandry, arising from long-followed practices, when the conditions of production have gradually but materially changed during their existence.

4. To carry into practical effect the collection of the information upon which these statistical tables are constructed, and the articles just referred to, it became necessary to lay them at brief intervals before the public, that correspondents, seeing the good they were accomplishing, might be encouraged to continue their aid, and that farmers and others should receive this information at such times as would most attract their attention and best benefit them. These objects demanded a publication such as the monthly and bi-monthly reports of this department. Their rapid and continued favor with all classes gives the best assurance of their utility.

Whilst their preparation devolves a most laborious and responsible duty on this division, yet such duty is not to be avoided when the practical objects of the department so imperatively demand its faithful performance. It is a laborious task because of the great variety of statistical tables required, and the numerous calculations embraced in them; and it is a responsible labor, not only because of the knowledge in agriculture and statistics which it requires, but on account of the effect which these tables exert over the commercial business of the country.

5. In the accumulation of general statistics this division has made all necessary progress, and its arrangements will occupy all the time that can be given it from the special and more pressing duties.

The issuing the circulars and distribution of the reports constitutes no small item of labor. During the year over 30,000 of the former have been sent to correspondents, and of the reports nearly 100,000 have been sent through agricultural societies and members of Congress to every county in the coun ry.

The meteorological portion of my reports is prepared partly at the Smithsonian Institution, and partly at this department, from the observers engaged for the Institution, who make monthly returns and deserve the thanks of the country for the unpaid discharge of this laborious and useful duty.

I would renew my suggestion of last year, that if under the direction of the government the state of the weather at different points of the country could be daily communicated by telegraph so as to be immediately spread over the whole country, very important and beneficial results might follow.

The distributions from the experimental and propagating garden during the year have consisted principally of grapes, strawberries and other small fruits. About 30,000 articles have been disseminated through the usual channels.

Considerable misapprehension exists relative to the distribution of the products of the garden.

Letters are constantly received enclosing extensive orders for fruiting vines and trees, as well as for all kinds of nursery stock. It is clearly beyond the intention of the government to supply such demands; it is undoubtedly the duty of the executive of this department to ascertain and decide upon the best means for these distributions; I have therefore aimed to avoid sending articles into localities where they are already well known, and have endeavored to make the distributions the means of testing varieties of plants in given localities where they have not previously been introduced, and thus assist in popularizing the best varieties in all sections of the country.

The celebrated Yeddo grape from Japan, received through the kindness of the honorable Mr. Pruyn, has been largely propagated, and distributed into various localities in order to test its adaptability to soils and climates. It is yet too early to decide as to its value, but the many inquiries received concerning it prove that it is attracting attention, and the coming season will go far to prove whether or not it is worthy of extended culture. Second only to the introduction of new varieties of plants is that of testing the respective merits of those already in cultivation. For this purpose every effort is made to procure specimens of all known kinds, so that they may be grown under similar conditions, in order that their peculiarities may be accurately noted, and those most worthy of culture ascertained.

Among those that have so far received most attention may be mentioned the grape, strawberry and currant—the impulse for the improvement of the native grape has already resulted in the production of many valuable varieties, as well as many that are only of local if not questionable merit. It is therefore my aim to procure these, test them, and report their true value, so that beginners in grape culture may not be led to purchase inferior kinds, and lose valuable years

of watchful care and attention, only to realize that their means and labor have been expended upon an inferior product.

This feature is one that I feel desirous of extending, so as to embrace all varieties of vegetables, grains and tubers, as well as fruits; but to do so in a satisfactory and proper manner will require greater facilities than are now provided; a tract of land of at least fifty acres in extent, embracing varieties of soil and surface, would not more than suffice for the proper development of these objects.

I had designed, during the past summer, to cultivate the land on government reservation No. 2, between 12th and 14th streets, the use of which has been granted me by the Commissioner of Public Buildings, but I have been obliged to suspend my operations there, as the government still uses it for a cattle yard.

The demand for seeds has been greater than during any previous year, and returns from those to whom they have been sent are most gratifying, not only as to the quality of the seeds, but in the introduction of new and valuable varieties. I am convinced that the imported vegetable and flower seeds distributed have been of immense benefit to the people.

The distribution of wheat in 1863 gave such general satisfaction, and caused so much inquiry, that I determined this year to extend its dissemination still further, and accordingly imported several hundred bushels, which have been scattered through every loyal State. Very superior varieties of oats from Sweden, and other grains, have been distributed. Of wheat and other grains there have been sent out over 38,000 bags, holding nearly a quart each, making over 1,000 bushels.

The whole number of packages of seeds of every kind sent out has been over 1,000,000; of these about one-half were distributed through members of Congress; nearly 200,000 to agricultural societies; 35,000 to statistical correspondents, and nearly 300.000 to the people of the country applying directly for them.

The introduction of sorghum and imphee, and the dissemination of the seed of these plants, by the Agricultural Department, has been worth millions of dollars to the country, more especially to the middle and western States, where they are destined to make a valuable and paying crop.

The manufacture of large quantities of beautiful sugar has proved that what was at first regarded as a doubtful experiment has become a fixed and most important fact, and although sugar may not be everywhere made, there is scarcely a State where large quantities of most excellent sirup are not manufactured. The seed of these plants has, however, so much deteriorated by hybridizing with our broom corn that I have deemed it of great importance to procure fresh seeds from their native localities, and have accordingly sent an educated, intelligent, and reliable person to China, with directions to purchase seed, and to ascertain minutely the method of making the sugar as practiced by the natives of that country. I hope to obtain a supply of the seed in season for planting next spring.

The manufacture of sugar from the "sugar beet" is attracting considerable

attention in some parts of the west, and it is hoped will prove successful and profitable.

The almost total extinction of the manufacture of cane sugar in the southern portion of our country has given a new and increased interest to the production of this necessary of life.

While the sorghum has been successfully introduced within a few years throughout the west, the beet, as a sugar-producing plant, has not till recently been considered economical.

The present exorbitant price of sugar has, however, induced some enterprising cultivators in Illinois to attempt the culture of the sugar beet with great promise of success.

Perhaps there is no soil or climate more suitable for this than that of the rich and fertile State of Illinois, whose deep alluvial soil is particularly well adapted to these roots, and there is now no reason why great quantities of the very best sugar should not be made there.

The manufacture of beet sugar, first introduced to France by the Emperor Napoleon I., not sixty years ago, has become an immense business there and on other parts of the continent.

The yield of beet sugar in 1861 was 480,000 tons—being one-sixth of all produced in the world, and one-fourth as much as the cane sugar.

The sugar product of the world was as follows:

Cane sugar..tons..	1,950,000
Beet sugar..tons..	480,000
Palm sugar..tons..	100,000
Maple sugar..tons..	20,000
	2,550,000

Considering that we pay nearly $100,000,000 annually for foreign sugar, and that this may be made from the beet at less than half the present price of sugar from the cane, it would seem to be the part of wisdom in the government to encourage it in some direct form.

The commissioners appointed by me to investigate "the practicability of cultivating and preparing flax and hemp as substitutes for cotton," under the act of Congress passed March, 1863, have been engaged during the year in pursuing their examination of mills, machines, modes of operating and cultivating. They will report in January next.

The commission has been changed by the substitution of Hon. Charles Jackson, of Providence, R. I., for Wm. M. Bailey, resigned.

(During the past year I have established an extensive correspondence with our consuls in foreign ports, the results of which have been laid before the people in my bi-monthly report; to many of these, whom I cannot here name, and to the Department of State, I am under great obligations for valuable information, seeds, plants, and other favors transmitted from them.)

Deeming the assistance and co-operation of the agricultural societies and

farmers' clubs throughout the country of the greatest importance, I have endeavored to continue my correspondence and connexion with them, not always, however, with the success I could wish.

From the first organization of the Department the formation of an agricultural cabinet has been deemed by me an object of great importance, but until this year a want of room has entirely prevented any attempt to establish it.

By the act of Congress passed last July, however, authorizing me to furnish rooms for my accommodation outside of the Patent Office building, I have been enabled to appropriate for this purpose two small rooms in the basement, near my office, but quite insufficient for the object. These have been appropriately fitted with cases and placed under the charge of the entomologist of the Department, who, in addition to the objects of interest daily received, has placed there his own collection of insects, birds, and models of fruits, over two thousand in number.

A great many interesting specimens have been received, and the cabinet is fast outgrowing its limits. Such a collection as is wanted should contain specimens of every department of natural history, and of all fruits, grains, and other productions of the soil. It should also have a complete herbarium, containing all the plants of the country, for the purpose of study, and to identify many which are sent for examination, especially such as may be used for textile fibres, or for the manufacture of oil, sugar, starch, dying matter, &c., also specimens of the different soils and rocks.

If suitable rooms were provided, such a collection could be made up, with but little expense, by gratuitous contributions from every State of the Union; and it would be of immense interest and benefit to all, not only as a means of reference in doubtful cases, but also as a guide to the agriculturist in the choice of seeds, plants, or fruits suitable to any locality or soil in any State.

During the year all letters and queries relating to the subject of insects injurious to various crops have received the attention of the entomologist, who has also prepared a report on the subject of insects injurious to vegetation, and the means of their prevention and destruction, a portion of which has been published in the report of 1863, to be finished in my next.

The destruction of various crops and fruit by insects has been very great this year, and has become a very serious trouble to the farmers, calling for more thorough examination and diffusion of information.

Sheep husbandry, always one of the most important of agricultural pursuits, has recently assumed an increased consequence from the great demand for woollen goods.

With the view of obtaining more definite information on the subject, and with the hope of inducing our farmers to engage more largely in wool-growing, and by producing the qualities most desired by the manufacturers, to check importation, I have addressed circulars to all the woollen manufacturers in the country, asking the quality and quantity consumed by each, and the kind that it is deemed most desirable to increase.

The result of this investigation, when obtained, will be at once published for the benefit of the farmers, and it is believed it will be of so convincing a nature as to cause a very large increase of their flocks.

Farmers have experienced much difficulty the past season in procuring laborers, and this has been but partially met by immigration, which, however, has been larger than in preceding years.

The number of emigrants arriving at New York in the year ending September 30, 1864, was	177, 823
Arriving at Boston	5, 204
Arriving at Philadelphia	4, 483
Arriving at Baltimore	2, 203
	189, 713
Eleven months, ending November 30, 1863, gave	146, 519
And the year 1862	76, 306

It is certainly gratifying to notice this vast increase under what were supposed to be disadvantageous circumstances.

My annual report for 1863 is but just issued; the great delay is owing, as I am informed, to a want of paper at the government printing office, and an absolute impossibility of supplying it.

I believe the volume will be found equal in interest and value to the preceding one.

The balance of the appropriation for the service of this Department for the fiscal year ending June 30, 1864, remaining unexpended on the 1st of December, 1863, was $51,758 81. A special appropriation was granted March 14, 1864, to supply various deficiencies, amounting to $4,770.

The following amounts were appropriated for the fiscal year ending June 30, 1865, viz: per act of June 25, 1864, $143,100; per act of July 2, 1864, $3,704 05, to enable the Commissioner of Agriculture to pay a debt incurred by the Commissioner of Patents in preparing the agricultural report for 1861, &c., and $300 to restore the salary of the chief messenger; and per act of July 4, 1864, $3,500, to pay the rent of additional rooms for the use of the department, making a total of $150,604 05.

There has been expended from December 1, 1863, to November 30, 1864, inclusive, $111,233 35, leaving an unexpended balance of $95,899 51.

Of the special appropriation of $20,000 "to test the practicability of preparing flax and hemp as a substitute for cotton," there has been expended $4,939 60, leaving a balance of $15,060 40.

In conclusion, I beg most respectfully to suggest that there never was a time in the history of this country when its agriculture was so important to its development, and so essential to its continued progress; or when the government should so freely and generously extend to it every possible aid and encouragement. In the full measure of its limited means, this department is doing every-

thing which earnest endeavor and assiduous labor can accomplish; and it has, I trust, so far commended itself to the confidence of the people that their honored representatives will continue to afford the liberal aid and encouragement it has heretofore received at their hands.

The continuance of the war has imposed upon this great interest of our country a twofold obligation. It has first withdrawn from agriculture its effective force of men and animals, converting them, moreover, into non-producing consumers; and it has then required it to support this vast body of non-producing consumers, in addition to the largely increased demands of our growing manufactories, of the mines, and of the cities, whose teeming millions must be fed, as well as the immense immigration, the increasing tide of which is flowing rapidly to our shores.

Nor are these the only claims upon our agricultural interests which it has successfully met. Commerce looks to it as its main support. It must not be forgotten that our surplus grain—that which is grown in excess of home consumption—freights our merchant ships, and is the chief commodity with which, at present, we discharge the obligations necessarily incurred abroad.

And it is not improper to notice in this connexion the gratifying fact that a beneficent Providence, amid the terrible calamity with which our country has been visited, has still grown such abundance in our fields and granaries that we can feed the hungry of other nations, having enough and to spare for our increased necessity.

Let us remember that it is the love of agriculture, and those who develop and teach it, which distinguishes the civilized from the uncivilized nations of the earth.

As a great and Christian people, whose beneficence heretofore has brought upon us the blessings of those who were ready to perish, we may well strain every nerve that again, if need be, we may become the Almighty's almoners to the nations of the earth.

I venture to hope that the next annual report of this department will embrace the agricultural statistics of the whole United States, to be forever and uninterruptedly thereafter "one and inseparable," prosperous and free.

Respectfully,

ISAAC NEWTON,
Commissioner of Agriculture.

His Excellency ABRAHAM LINCOLN, *President.*

VIRGINIA: HER PAST, PRESENT, AND FUTURE.

BY SAMUEL M. JANNEY.

It is my purpose in this paper to give a concise account of the natural resources of Virginia, and of the extent to which they have been improved, showing the condition of the State before she subjected herself to the desolating scourge of civil war, and pointing out what she may become when peace shall be restored, with the advantages of free labor, enlightened enterprise, and general education.

The organization of West Virginia as a separate State has taken from the Old Dominion one-third of her territory. The area now remaining is 31,594 square miles, and may be appropriately described under four heads, viz: The Tide-water region, the Piedmont region, the Great Valley, and the Trans-Alleghany region.

THE TIDE-WATER REGION.

The tide-water region extends from the sea-coast to the head of tide. A line drawn across the State, touching Petersburg, Richmond, and Fredericksburg, which are seated near the lower falls of the Appomattox, the James, and the Rappahannock rivers, will cut off most of this region. It is penetrated by many navigable streams, emptying into Chesapeake bay, which, together with coves and estuaries connected with the bay, furnish an abundant supply of fish, oysters, crabs, and wild-fowl.

The soil is of diluvial formation, and generally level or moderately undulating; the river bottom is very rich, but much of the intervening land is sandy or gravelly. There are, however, in many places, considerable tracts of land, originally good, that might be improved or renovated by the application of marl, which is found in abundance.

The two counties on the Eastern Shore, Accomac and Northampton, are separated from the rest of the State by Chesapeake bay. They are together seventy-eight miles long and about ten miles wide; the surface is level and the soil light and sandy, but with proper cultivation tolerably productive. The principal products are Indian corn, oats, sweet potatoes, and fruit.

In the county of Norfolk much attention has recently been devoted to market gardening, mostly through the enterprise and skill of settlers from the north. Early vegetables produced there are sent by steamers to the northern cities, yielding large returns. Although little more than one-third of that small county is returned in the census as "land improved in farms," yet the "market garden products" in the year 1860 were valued at $292,968; rendering Norfolk in that respect incomparably ahead of any county in the State.

The Dismal Swamp, which lies partly in the county of Norfolk and extends into North Carolina, is nearly thirty miles in length from north to south, and averages in width about ten miles. Five navigable rivers are said to rise in this swamp. The soil is a complete quagmire, trembling under the feet where it is not covered with water. A part of the swamp is overgrown with reeds, but a considerable portion of it is covered with a large growth of cypress and cedar timber. Many of the trees being prostrated by the wind, the ground is

covered by their trunks; they are also found in layers deeply imbedded in the soil, where they have doubtless lain for ages. When disinterred they furnish a great quantity of excellent timber for shingles and wood ware. The Seaboard and Roanoke canal passes five miles across the northern part of the swamp. "It looks like a grand avenue surrounded on either hand by magnificent forests. The trees here—the cypress, juniper, oak, pine, &c.—are of enormous size and richest foliage; and below is a thick entangled undergrowth of reeds, woodbine, grape-vines, mosses, and creepers, shooting and twisted spirally around, interlaced and complicated, so as almost to shut out the sun."*

In the interior of the swamp there is a body of water called Lake Drummond, from which a feeder conveys water to the Dismal Swamp canal. This important public work, twenty-two miles long, is navigable for sloops and schooners, and connects the port of Norfolk with Albemarle sound, North Carolina. The greater part of its length being located in the Dismal Swamp, rendered it a work of great labor and difficulty.

Norfolk was first established as a town in the year 1705, and formed into a borough in 1736. Its population was in 1775 about 6,000; in 1820, 9,478; in 1840, 10,920; and in 1860, 14,620; of whom 10,290 were white persons, 1,046 free colored, and 3,284 slaves. Its fine harbor is open at all seasons of the year, and few cities have a better location for foreign commerce. The steamers that ply on the Chesapeake bay furnish the means of intercourse with the northern cities; the Seaboard and Roanoke railroad communicates with the southern coast; and the railroad to Petersburg connects there with the lines leading south, west, and north.

Portsmouth, the seat of justice of Norfolk county, is on the west bank of the Elizabeth river, immediately opposite Norfolk, and distant about three-fourths of a mile. It was established as a town in 1752, and by the census of 1860 had a population of 9,496, of whom 8,019 were white, 543 free colored, and 934 slaves. In common with Norfolk, it enjoys the advantages of one of the best harbors in the Union, admitting vessels of the largest size. Half a mile from the central part of the town, in that portion of it called Gosport, the general government had a large and costly dry-dock, capable of admitting the largest ships. In the navy yard adjacent there were at times employed as many as 1,400 men, whose expenditures contributed greatly to the support of the town. In the early part of the rebellion this dry-dock and navy yard were destroyed by the insurgents.

Richmond is the principal city in the tide-water region of Virginia. It is situated in Henrico county, on the northern bank of the James river, near the head of tide, and 106 miles from Norfolk. Its location is beautiful, comprising Shockoe and Richmond hills, with Shockoe creek, a bold and lively stream, flowing between them. The falls of the James river, opposite the city, are very picturesque, a great body of water rushing and foaming along the rocky bed. The water-power furnished by the river is very great, and part of it has been most advantageously employed for manufacturing purposes.

The flouring mills of Richmond are probably equal to any in the world, both in the perfection of their machinery and in the quantity and quality of the flour produced.

The Gallego mills, situated on the basin of the James river canal, and supplied by it with water, have 31 pairs of burr-stones, driven by three waterwheels 32 feet high, and three wheels 18 feet high, the fall being so great that the same water is used twice before it leaves the mills.

They have manufactured in one year 190,000 barrels of flour, and are capable of making 1,500 barrels per day. They occupy three buildings connected together, one of which is eleven stories high.

* Howe's Virginia, p. 402.

The Haxall mills are on the river bank, and driven by water taken from the falls by a wing-dam. They have manufactured usually about 160,000 barrels of flour in a year. The flour from the Gallego and Haxall mills commands a higher price than any other, on account of its peculiar quality of keeping sweet on long voyages and in hot climates. In the markets of Brazil and Australia it has the preference over all other flour.

In the manufacture of chewing tobacco, Richmond has surpassed all other cities in the Union. In the year 1860 there were fifty tobacco factories, each employing an average of one hundred men, women, and children.

There are in and around the city other manufactories of considerable importance, among which the Tredegar iron-works are probably the most valuable.

The water-works supply the inhabitants with an abundance of pure water thrown up from the James river by hydraulic machinery.

There are few cities in the Union that have greater natural facilities for manufacturing purposes than Richmond. In addition to its vast water-power, there are, in the county of Henrico and in the adjoining county of Chesterfield, rich deposits of bituminous coal, which have been mined very successfully, furnishing an abundant supply for the use of the city, and some for shipment.

The coal region of eastern Virginia is supposed to be about fifty miles long and twelve broad, extending through several counties. The seams of coal lie at a considerable depth below the surfce, some of the pits being from 600 to 1,000 feet deep. It is so near the seaboard, however, that the facility of transportation compensates for the cost of raising it from the mines.

In public works for travel and transportation of merchandise, few cities are more liberally provided than Richmond. The James river canal, which has there its eastern terminus, extends through the Blue Ridge to Buchanan, forty-five miles west of Lynchburg, and brings to market the abundant products not only of the Piedmont region, but of the great valley beyond.

The following important railroads centre at Richmond, viz: The Virginia Central railroad, extending one hundred and sixteen miles to Staunton, and connected at Gordonsville with the Orange and Alexandria railroad; the Richmond, Fredericksburg, and Potomac railroad; Richmond and York River railroad; the Danville railroad, connecting with the Petersburg and Lynchburg railroad; the railroad to Petersburg, connecting with those which lead to Weldon and to Norfolk.

The James river is navigable for large ships to City Point, and for vessels of two hundred tons burden to Rockets, within the limits of Richmond.

With all these natural advantages and public works, the city of Richmond must hereafter assume a very important position, and receive a great increase of population. The number of inhabitants in 1800 was 5,737; in 1810, 9,785; in 1820, 12,067; in 1830, 16,060; in 1840, 20,153; in 1850, 27,570, and in 1860, 37,900; of whom 23,625 were white persons, 2,576 free colored, and 11,699 slaves.

Manchester, on the James river, opposite to Richmond, has two flouring mills, capable, together, of making about 1,200 barrels of flour per day. It has also two large manufactories of cotton and wool.

Petersburg, on the Appomattox river, twenty-three miles south of Richmond, is a city of importance for its commerce and manufactures. The water-power derived from the river has been applied to operate flouring mills and cotton manufactories. Wheat, corn, flour, and tobacco are staple articles of commerce, and cotton has been brought thither in considerable quantities from the southern counties of Virginia and from North Carolina. The population was in 1830, 21,910; in 1840, 22,558; in 1850, 14,010; and in 1860, 18,266; of whom 9,342 were white, 3,244 free colored, and 5,680 slaves.

NOTE.—This article was prepared previous to the destruction of property in 1865.

Fredericksburg, on the south side of the Rappahannock river, one hundred and fifty miles from its mouth, is sixty-two miles from Richmond and fifty-six from Washington city. Its population in 1860 was 5,023. Being near the falls of the Rappahannock, it has a valuable water-power.

Alexandria, six miles from Washington city, on the opposite side of the Potomac river, possesses great natural advantages, having a good harbor, accessible to ships of large size, and being connected by a canal and two railroads with the rich counties of Loudon and Fauquier, and with the valley of the Shenandoah. An extension of the Chesapeake and Ohio canal to Alexandria has made this port an eligible depot for the Cumberland coal trade, which has become an interest of vast importance, owing to the peculiar fitness of this coal for generating steam. The population of Alexandria was in 1840, 8,459; in 1850, 8,752; and 1860, 12,654; of whom 9,851 were white, 1,417 free colored, and 1,386 slaves.

In most of the counties throughout the tide-water region of Virginia there was, before the present war, a great extent of waste land that had been impoverished by injudicious cultivation in corn and tobacco.

The practice of ploughing only three or four inches deep, and raising tobacco and corn, or corn and oats every year, without sowing grass seed or allowing fallow, must be injurious even to the best lands, and is ruinous to those of average fertility. It is remarkable that this result generally follows in all slaveholding countries, owing doubtless to the negligent and unthrifty habits which always attend that unrighteous practice.

It seems to be a law of nature that the land must have its Sabbaths, or if not permitted to rest from tillage will lose its fertility. The provision in the Mosaic code that the Israelites should abstain from agriculture every seventh year was probably intended to prevent the soil from being exhausted by excessive cultivation. Moses, describing the calamities that would ensue from the infraction of his laws, says: "Then shall the land enjoy her Sabbaths; as long as it *lieth desolate* it shall rest, because it did not rest in your Sabbaths when ye dwelt upon it."—*Levit.* xxvi, 35.

A large portion of the land in eastern Virginia now lies desolate, having been brought to that condition by the scourge of civil war, resulting from disobedience to the Divine law and disregard to the first principles of civil liberty.

It is about twenty-five years since the impoverished lands of Fairfax and of some other counties in eastern Virginia began to attract the attention of capitalists and agriculturists from the free States.

It was stated in the year 1845 that about one hundred and twenty families from the northern States had then settled in Fairfax county, and had purchased 24,000 acres of land, at a cost of about $180,000. These settlers, by their industry and skill, not only fertilized and beautified their own estates, but imparted to their neighbors a portion of their indomitable energy, and caused a spirit of improvement to spread around them. In a few years the price of land advanced twenty-five to one hundred per cent., or an average, probably, of fifty per cent. From that date until near the opening of the rebellion the immigration from the north to the tide-water region of Virginia continued, and the beneficial results were obvious to all. But the march of improvement has been ruthlessly arrested, the hand of violence has driven most of those peaceful settlers from their homes, and many of their farms are now desolate.

The following tables, compiled from the United States census of 1860, exhibit the population, area, and staple products of Virginia at that date. In addition to these staples there were produced upwards of 12,000 bales of ginned cotton of 400 pounds each. In this culture Essex county stands first, producing 4,600 bales, and Southampton second, producing 2,563 bales.

Population of the tide-water region in Virginia, according to the United States census of 1860.

Counties.	Whites.	Free colored.	Slaves.	Total.
Accomac	10,661	3,418	4,507	18,586
Alexandria	9,851	1,415	1,386	12,652
Caroline	6,948	844	10,672	18,464
Charles City	1,806	856	2,947	5,609
Chesterfield	10,019	643	8,354	19,016
Dinwiddie	13,678	3,746	12,774	30,198
Elizabeth City	3,180	201	2,417	5,798
Essex	3,296	477	6,696	10,469
Fairfax	8,046	672	3,116	11,834
Gloucester	4,517	703	5,736	10,956
Greenville	1,974	233	4,167	6,374
Hanover	7,482	257	9,483	17,222
Henrico	37,985	3,590	20,041	61,616
Isle of Wight	5,037	1,370	3,570	9,977
James City	2,167	1,045	2,586	5,798
King George	2,510	388	3,673	6,571
King and Queen	3,801	388	6,139	10,328
King William	2,589	416	5,525	8,530
Lancaster	1,981	301	2,869	5,151
Matthews	3,865	218	3,008	7,091
Middlesex	1,863	126	2,375	4,364
Nansemond	5,732	2,480	5,481	13,693
New Kent	2,146	364	3,374	5,884
Norfolk	24,420	2,803	9,004	36,227
Northampton	2,998	962	3,872	7,832
Northumberland	3,870	222	3,439	7,531
Prince George	2,899	515	4,997	8,411
Prince William	5,690	519	2,356	8,565
Princess Anne	4,333	195	3,186	7,714
Richmond	3,570	820	2,466	6,856
Southampton	5,713	1,794	5,408	12,915
Spottsylvania	7,716	574	7,786	16,076
Stafford	4,922	319	3,314	8,555
Surry	2,334	1,284	2,515	6,133
Sussex	3,118	673	6,384	10,175
Warwick	662	59	1,019	1,740
Westmoreland	3,387	1,191	3,704	8,282
York	2,342	682	1,925	4,949
Total	229,108	36,763	192,271	458,142

Statistics of the tide-water region of Virginia, from the United States census, 1860.

COUNTIES.	ACRES OF LAND. Improved in farms.	Unimproved in farms.	Cash value of farms.	Value of live stock.	Bushels of wheat.	Bushels of Indian corn.	Bushels of oats.	Pounds of tobacco.	Pounds of wool.	Pounds of butter.	Tons of hay.	Value of animals slaughtered.
Accomac	84,889	81,762	$3,979,720	$345,628	29,342	624,717	366,200	....	8,227	45,158	....	$154,780
Alexandria	8,291	6,969	853,260	44,445	5,505	34,335	16,975	....	420	10,375	1,815	5,035
Charles City	50,267	48,190	1,239,410	165,955	126,921	199,080	40,341	37,930	4,169	31,170	....	32,347
Caroline	183,799	122,123	4,407,613	450,654	214,565	650,752	84,165	3,514,413	13,960	82,249	3,233	107,750
Chesterfield	106,999	154,973	3,263,370	399,767	133,350	366,130	101,138	1,399,568	8,607	68,073	491	70,567
Dinwiddie	118,440	169,086	2,643,250	484,278	133,515	354,622	83,223	3,854,812	8,738	63,764	349	97,762
Elizabeth City	17,534	13,905	1,273,050	123,845	44,013	116,025	20,340	94,000	3,059	29,640	630	39,767
Essex	96,415	60,707	2,439,173	269,403	123,871	445,527	18,966	64,139	11,758	33,837	145	66,540
Fairfax	84,690	115,916	3,866,075	371,443	49,318	263,225	155,409	29,100	14,391	163,166	8,088	68,491
Gloucester	58,708	53,418	2,001,234	225,926	100,436	296,255	30,607	6,370	1,102	41,465	2,568	40,321
Greenville	70,317	97,648	982,900	186,375	43,105	225,970	17,424	685,963	4,242	18,053	11	69,495
Hanover	141,205	218,120	4,203,120	514,828	237,402	535,862	168,061	2,428,978	15,449	104,327	2,167	122,116
Henrico	69,220	66,490	5,128,610	423,672	217,293	357,285	82,247	671,380	3,574	68,326	2,109	115,479
Isle of Wight	64,755	110,563	1,531,290	252,697	31,852	340,865	27,765	6,227	5,953	25,722	852	135,052
James City	25,003	52,715	1,011,340	125,593	57,220	119,460	18,573	2,030	2,305	21,163	1,165	30,024
King George	70,753	42,743	1,933,469	203,691	116,609	307,660	27,675	53,660	10,168	31,325	5,096	40,214
King and Queen	108,107	76,925	2,454,708	252,349	107,357	425,423	14,221	209,819	11,115	43,303	....	71,575
King William	99,674	64,239	2,568,250	232,290	148,094	400,660	20,736	397,403	12,096	48,331	2,081	70,225
Lancaster	34,925	38,742	1,307,441	131,475	80,862	179,805	11,623	6,380	3,757	21,342	16	43,115
Mathews	29,594	19,838	1,450,460	127,970	46,677	167,813	24,060	1,076	3,612	25,603	598	58,164
Middlesex	36,624	31,655	1,145,060	110,887	59,939	163,467	7,046	21,950	5,625	25,755	3	41,654
Nansemond	59,708	112,750	1,680,210	244,452	15,022	411,975	26,065	400	3,018	29,760	58	150,185
New Kent	46,310	66,965	1,331,275	170,821	63,592	198,350	23,367	54,030	4,359	44,637	309	31,365
Norfolk	47,985	81,794	2,140,252	251,378	5,924	454,116	20,746	100	2,366	36,737	3,198	97,299
Northampton	56,402	49,065	2,184,150	280,875	39,686	377,205	222,995	....	7,273	26,140	....	86,525
Northumberland	54,459	53,390	1,701,047	199,833	92,441	245,982	15,909	7,527	8,449	29,248	464	68,792
Prince George	63,777	83,809	1,947,415	228,861	133,294	305,135	32,037	565,090	4,010	36,685	3,529	53,799
Prince William	97,353	76,746	2,373,100	318,445	54,069	188,270	96,489	12,921	24,327	96,535	4,239	62,089
Princess Anne	57,612	75,140	1,860,486	290,847	23,147	369,070	54,247	....	7,730	27,373	1,774	106,255
Richmond	52,094	43,630	1,270,037	148,261	89,067	225,265	7,133	500	4,065	26,439	2,111	49,427
Southampton	131,963	168,708	1,615,065	374,105	12,287	572,995	28,525	100	8,596	13,267	5,088	258,363
Spottsylvania	116,007	117,059	2,394,424	313,797	132,305	255,820	89,265	1,626,400	9,747	51,775	870	66,267
Stafford	62,377	63,960	1,536,580	202,073	61,919	182,105	54,464	148,975	10,570	62,581	1,900	53,134
Surry	50,306	123,922	1,082,056	152,802	36,761	201,820	27,123	46,875	3,770	10,915	1,765	49,860
Sussex	126,088	134,426	1,601,905	359,821	87,359	405,979	63,442	592,040	10,145	43,607	2,422	130,560
Warwick	12,093	25,144	406,250	55,682	18,878	67,875	5,915	....	1,506	11,425	351	19,645
Westmoreland	76,100	55,415	1,931,680	219,364	125,890	342,315	19,091	38,875	7,315	31,265	2,660	43,643
York	28,030	39,697	1,167,320	124,627	38,334	157,421	15,245	71,800	3,497	40,442	888	34,849
Total	2,698,873	3,009,347	77,906,005	9,379,215	3,137,221	11,536,636	2,138,853	16,650,831	273,070	1,620,980	63,043	2,872,530

THE PIEDMONT REGION.

The Piedmont region of Virginia extends from the head of tide to the Blue Ridge, and derives its name from its situation at the "foot of the mountain." Its lower section is generally undulating, while the upper section is hilly, and through the greater part of its length has a range of mountains east of the Blue Ridge, and lying parallel with it, at an average distance of about fifteen miles, which are known under various names, as the Catoctin, in Loudon; the Bull Run mountain, in Fauquier; the Southwest and the Green mountains, in Albemarle; and the Buffalo Ridge, in Amherst.

The Blue Ridge, in Loudon county, rises to an elevation of from 300 to 700 feet above its base, or from 1,000 to 1,400 feet above tide-water. Further south it is in some places higher; and at one of the Peaks of Otter, in Bedford county, the altitude is estimated at 4,200 feet above the plain, and 5,307 feet above the ocean.

The Catoctin mountain, in Loudon county, ranges from 350 to 730 feet elevation above the level of tide-water.

The primordial formation of rocks begins near the head of tide. On the Potomac gneiss is found in large masses, extending some miles below the falls. At Occoquan, near the head of tide, both gneiss and granite are abundant, and on the James river, a few miles above Richmond, a beautiful white granite is found. The drift formation covers most of the gneiss except on the margin of streams, where it has been removed. As we advance some distance above tide-water the rocks come to the surface, and from their disintegration the soil has been formed, which depends for its fertility, in a great measure, on the character of the strata from which it has been produced. The disintegration of the rocks which are scattered in fragments over the surface is still going on, by the instrumentality of air and moisture, changes of temperature, and the action of acids generated by vegetation.

It is remarked by Liebig that "thousands of years have been necessary to convert stones and rocks into the soil of arable land, and thousands of years more will be required for their complete reduction; that is, for the complete exhaustion of their alkalies."

Professor Rodgers, in one of his reports to the legislature of Virginia, says that any line drawn across the State at right angles to the head of tide-water would present the same general appearance; there would be variations, as a member of the series in one line might thin out, or be wanting on another line, yet the same general features would prevail.

In the region extending from the Blue Ridge to the head of tide there is a great variety of rocks, among which are granite, trap, gneiss, mica-slate, hornblende-slate, clay-slate, sandstone, limestone, and epidote. "In this region there are some belts of fine soil, formed from rocks composed largely of feldspar and hornblende. There are other sections in which the soils are composed of the ruins of gneiss and granite. These soils are sandy and less valuable. Again, there are localities in which the soil has originated from rocks composed chiefly of quartz, with small quantities of mica or feldspar, or both. Such regions are hopelessly deficient in some most important elements of mineral fertility."*

There is a belt of red land extending from the Potomac, through a part of each of the counties of Loudon, Fairfax, Prince William, Fauquier, Culpeper, and Orange, which, with judicious cultivation, may be made very productive. It is known as the red sandstone formation.

Professor W. B. Rogers, in his report to the legislature of Virginia in 1840, describes it under the head of the secondary formation in the northern district. He says:

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* Professor J. L. Campbell, Southern Planter, Vol. xx, No. 7.

"The general form of this area is that of a prolonged triangle, extending in a direction from S.SW. to N.NE., having its apex at the southern extremity, and gradually expanding until it reaches the Potomac. Measured from a point on the Potomac between the mouths of Goose creek and Broad run. its length is about 80 miles. Its greatest breadth, as measured near the Potomac, and parallel to the road leading from Leesburg to Dranesville, is about 15 miles. This, in round numbers, gives 600 square miles for the area of this region."

The rocks, in a transverse line, beginning a little east of Dranesville, and extending to the Catoctin mountain, near Leesburg, are described in the following order, viz: red sandstone, red shale, greenstone, trap, reddish slate, and conglomerate composed of limestone pebbles.

The conglomerate marble, or breccia, is found in abundance at the eastern base of the Catoctin, from Leesburg to the Point of Rocks, and extends into Maryland. Of this variegated marble were formed the beautiful columns in the old Representatives' chamber of the Capitol at Washington. The soil on which this rock is found is very productive and valuable.

A large bed of compact red oxide of iron lies at the eastern base of the Catoctin mountain, near the Potomac river. A furnace was formerly in blast near the Point of Rocks for the reduction of this ore, and considerable quantities of it have been transported to a distance to supply other furnaces.* Copper ore is also found in the eastern part of Loudon, near the Potomac, and a few years ago was mined with success.

In the valley of Loudon, between the Catoctin mountain and the Blue Ridge, the soil is formed from gneiss, clay-slate, hornblende, greenstone, and quartz. The happy combination of these materials produces a most excellent and durable soil, containing, in fair proportions, alumina, silex, potash, lime, and other fertilizing minerals. Clover and plaster have been very successfully employed in improving its natural fertility, and when it is partially exhausted by excessive tillage, rest alone will restore it. Few counties are so well watered as this. Springs of soft water gush out in every direction, and almost every field is supplied with running water.

The census returns show the productiveness of the Piedmont region, and especially of those counties which lie immediately at the foot of the Blue Ridge; but there is no doubt that it might be made to yield far heavier crops by more thorough farming and the use of fertilizers.

In the northern portion of this region wheat, Indian corn, and hay are the staple productions. Some rye and oats are produced, but very little tobacco. Sheep husbandry is pursued to some extent; many horses are bred; and the grazing of cattle is a most important and productive branch of business. In the middle and southern part of the Piedmont region tobacco is a staple product, together with Indian corn, wheat, and oats.

The culture of tobacco is chiefly pursued in those counties where slaves are most numerous; and, being accompanied by the usual concomitants of slave labor, unskilfulness and negligence, it has exhausted the soil in many localities. It may, however, be readily renovated by judicious management.

In order to compare the results of grain-growing and tobacco-planting, take Loudon county, which produces more wheat and corn than any other county in the State, and Halifax, which stands first in the production of tobacco.

The area of Loudon is 296,142 acres, and the cash value of the land by the census of 1860 was $10,508,211, being $35 82 per acre. The area of Halifax is 474,465 acres, and the cash value of the land was at the same time $6,922,479, being $14 59 per acre. The white population of Loudon was, by the same census, 15,021; free colored, 1,252; and slaves, 5,501. The white population of Halifax was 11,060; free colored, 563; and slaves, 14,897.

The most populous and productive part of Loudon county lies between the Blue Ridge and the Catoctin mountain, extending from the Potomac about twenty miles south. It was settled originally by Pennsylvanians, many of

* Memoir of Loudon County, by Yardley Taylor.

whom were Friends, or Quakers. The farms are generally small, compared with those in other parts of the State, and the cultivation, being chiefly by free labor, has caused it to become the garden spot of Virginia.

There are no large cities in the Piedmont region. Lynchburg, in Campbell county, had, by the last census, 6,853 inhabitants; of whom 3,802 were white, 357 free colored, and 2,694 slaves. It is situated on a steep declivity on the south side of the James river, 116 miles from Richmond. It is a place of considerable trade in tobacco, grain, and flour. The James River canal furnishes a cheap conveyance to Richmond for these products. The Virginia and Tennessee railroad, 205 miles long, has its eastern terminus at Lynchburg, and the immense trade and travel which it brings are conveyed to the seaboard by the railroads leading to Petersburg, Richmond, and Alexandria.

Charlottesville, the county seat of Albemarle county, is beautifully situated in a fertile valley on the right bank of the Rivanna river.

The University of Virginia, one mile west from Charlottesville, is an institution that has been liberally fostered by the State, and has enjoyed a high reputation. It is provided with ample buildings, tastefully constructed, philosophical and chemical apparatus, and a large library.

Leesburg, the county seat of Loudon, had, by the last census, a population of 1,130. It is situated 36 miles from Alexandria, and connected with it by the Loudon and Hampshire railroad, which is designed to be extended to the coal-fields in Hampshire county.

Population of the Piedmont region in Virginia, according to the United States census of 1860.

Counties.	White.	Free colored.	Slaves.	Total.
Albemarle	12,103	606	13,916	26,625
Amelia	2,897	189	7,655	10,741
Amherst	7,167	297	6,278	13,742
Appomattox	4,118	171	4,600	8,889
Bedford	14,388	504	10,176	25,068
Brunswick	4,992	671	9,146	14,809
Buckingham	6,041	360	8,811	15,212
Campbell	13,588	1,029	11,580	26,197
Charlotte	4,981	252	9,238	14,471
Culpeper	4,959	429	6,675	12,063
Cumberland	2,946	310	6,705	9,961
Fauquier	10,430	821	10,455	21,706
Fluvanna	5,093	266	4,994	10,353
Franklin	13,642	105	6,351	20,098
Goochland	3,814	703	6,139	10,656
Greene	3,015	23	1,984	5,022
Halifax	11,060	563	14,897	26,520
Henry	6,773	314	5,018	12,105
Loudon	15,021	1,252	5,501	21,774
Louisa	6,183	324	10,194	16,701
Lunenberg	4,421	257	7,305	11,983
Madison	4,360	97	4,397	8,854
Mecklenburg	6,778	898	12,420	20,096
Nelson	6,649	128	6,238	13,015
Nottoway	2,270	98	6,468	8,836
Orange	4,553	187	6,111	10,851
Patrick	7,158	131	2,070	9,359
Pittsylvania	17,105	659	14,340	32,104
Powhatan	2,580	409	5,403	8,392
Prince Edward	4,037	466	7,341	11,844
Rappahannock	5,018	312	3,520	8,850
Total	218,140	12,831	235,926	466,897

Statistics of the Piedmont region of Virginia, according to the United States census, 1860.

COUNTIES.	ACRES OF LAND.		Cash value of farms.	Value of live stock.	Bushels of wheat.	Bushels of Indian corn.	Bushels of oats.	Pounds of tobacco.	Pounds of wool.	Pounds of butter.	Tons of hay.	Value of animals slaughtered.
	Improved in farms.	Unimproved in farms.										
Albemarle	245, 272	176, 942	$9, 157, 646	$899, 680	302, 307	729, 710	215, 273	5, 429, 395	40, 252	206, 728	6, 628	$267, 222
Amelia	109, 280	98, 658	2, 364, 058	372, 640	124, 200	283, 610	100, 763	4, 211, 036	12, 075	59, 743	323	77, 712
Amherst	111, 969	132, 949	2, 874, 596	370, 824	104, 110	313, 809	120, 047	2, 847, 209	7, 525	112, 779	1, 870	113, 351
Appomattox	85, 297	98, 609	1, 902, 558	265, 772	39, 376	169, 557	109, 363	1, 777, 355	10, 397	79, 897	461	77, 140
Bedford	189, 232	244, 617	6, 297, 453	837, 393	318, 277	449, 211	334, 767	4, 213, 088	21, 764	347, 011	6, 297	260, 058
Brunswick	160, 870	178, 984	2, 318, 267	430, 309	142, 155	427, 805	88, 043	4, 982, 052	12, 062	68, 329	6, 387	136, 857
Buckingham	136, 143	173, 493	3, 513, 277	419, 349	114, 921	291, 830	178, 132	4, 777, 000	18, 086	92, 577	1, 015	127, 021
Campbell	138, 628	151, 080	3, 712, 579	359, 778	150, 679	271, 339	152, 810	3, 505, 620	15, 181	107, 884	1, 729	124, 639
Charlotte	147, 407	145, 001	4, 398, 140	441, 494	161, 596	373, 929	194, 148	5, 666, 620	17, 046	80, 385	367	135, 023
Culpeper	153, 291	85, 567	4, 985, 786	540, 572	191, 358	442, 191	60, 074	179, 805	54, 992	107, 270	4, 765	114, 849
Cumberland	90, 746	80, 028	2, 355, 423	352, 135	82, 178	199, 313	113, 937	4, 627, 531	10, 459	54, 250	159	81, 191
Fauquier	268, 431	115, 048	10, 062, 472	1, 494, 504	280, 279	717, 450	178, 906	271, 232	102, 257	284, 005	11, 756	230, 192
Fluvanna	88, 635	69, 854	2, 332, 149	318, 213	127, 404	210, 287	97, 586	2, 583, 543	7, 349	76, 336	590	82, 686
Franklin	153, 212	254, 420	3, 684, 634	493, 103	124, 396	367, 587	227, 799	2, 643, 454	16, 267	158, 337	2, 798	164, 530
Goochland	83, 424	72, 636	2, 524, 327	348, 457	174, 129	276, 744	124, 228	2, 900, 553	11, 530	61, 479	1, 769	77, 718
Greene	44, 655	60, 209	1, 213, 979	154, 767	28, 743	136, 127	25, 094	790, 560	4, 806	50, 355	1, 033	49, 942
Halifax	277, 913	196, 552	6, 922, 479	684, 536	237, 518	533, 012	129, 790	8, 544, 522	22, 307	143, 795	104	257, 810
Henry	79, 955	141, 022	2, 341, 356	282, 659	57, 015	235, 840	82, 343	2, 588, 189	6, 285	88, 801	1	107, 290
Loudon	220, 266	75, 876	10, 508, 211	1, 182, 355	396, 297	930, 465	188, 717	....	42, 580	425, 117	12, 835	202, 746
Louisa	156, 950	132, 889	4, 461, 836	556, 856	258, 265	383, 683	165, 111	4, 798, 087	16, 422	93, 860	12, 427	130, 827
Lunenburg	110, 935	142, 546	2, 232, 979	360, 642	86, 332	294, 520	132, 631	4, 272, 081	10, 653	75, 559	31	88, 920
Madison	97, 421	115, 801	2, 816, 620	321, 897	99, 639	363, 360	44, 110	480, 475	14, 640	78, 829	65	113, 843
Mecklenburg	139, 840	202, 643	3, 606, 956	481, 246	161, 825	461, 290	172, 633	6, 631, 850	18, 380	97, 310	1, 677	144, 805
Nelson	118, 036	152, 948	4, 009, 504	352, 344	78, 306	339, 075	91, 646	2, 833, 618	12, 272	98, 807	1, 893	126, 182
Nottoway	[illegible]	88, 800	1, 729, 186	215, 527	[illegible]	218, 207	58, 472	3, 125, 450	5, 348	22, 546	57	50, 313
Orange	[illegible]	68, 993	3, 779, 299	448, 384	186, 022	312, 897	69, 569	1, 177, 702	23, 459	88, 195	2, 380	97, 468
Patrick	58, 064	168, 899	1, 278, 805	202, 808	19, 571	185, 202	55, 745	655, 454	6, 832	62, 155	278	69, 996
Pittsylvania	247, 156	332, 882	5, 760, 940	700, 695	184, 112	519, 374	259, 053	7, 053, 962	19, 929	192, 392	2	223, 732
Powhatan	68, 516	75, 213	2, 100, 284	273, 279	111, 841	280, 611	134, 335	2, 886, 611	11, 952	43, 950	4, 208	69, 105
Prince Edward	108, 536	106, 151	2, 957, 131	297, 433	79, 521	233, 833	122, 126	4, 231, 797	10, 152	67, 288	151	69, 241
Rappahannock	103, 880	46, 768	2, 860, 410	497, 815	89, 275	299, 356	45, 069	38, 280	23, 3[illegible]8	77, 665	3, 849	86, 409
Total	4, 169, 478	4, 186, 168	121, 063, 340	14, 957, 466	4, 603, 850	11, 251, 224	4, 072, 320	100, 724, 131	606, 607	3, 603, 634	87, 903	3, 958, 818

THE GREAT VALLEY.

The Great Valley of Virginia includes the region lying between the Blue Ridge and the crest of the Alleghany mountains, both of which ranges run nearly from northwest to southeast. Within these limits six counties are claimed by West Virginia, viz: Jefferson, Berkeley, Morgan, Hampshire, Hardy, and Pendleton. There seems to be some doubt, however, whether the two first amed are to be considered as belonging to the new State or not. This region extends through the State a distance of about 300 miles, and varies in width from 40 to 70 miles in some places, separated by ridges into two or more valleys. By geologists it is described as belonging to the silurian formation, which lies next in order above the primary; the rocks which enter most largely into its structure being limestones, several varieties of slate, sandstones and conglomerates. "The rocks on the western slope of the Blue Ridge, and on the spurs which extend out some distance into the valley, are chiefly slate and hard sandstone. As we descend into the valley, we find the formation consisting of a great variety of limestones, with vast beds of interstratified slates and shales, all containing fossil shells and coral. By their disintegration these rocks generally give soils of fine quality. In most parts of this valley the rocks have been very much tilted or warped at the time of their upheaval, thus giving rise to a peculiar and interesting variety of landscape. In many places we meet with abrupt precipices, such as are common along the banks of water-courses; in other places we find deep gorges like that spanned by the Natural Bridge, while the less sublime but no less beautiful hills, with their gently undulating and rounded tops, are found to cover the greater part of the surface throughout the whole length and breadth of this delightful section of our State."*

Although many beautiful streams flow through the valley, the farming lands are not so well watered as would be desirable, the limestone springs not being very numerous, though generally copious, some of them sufficiently large to turn a mill. There are belts of slate formation, considered inferior in quality to the limestone lands, but susceptible of improvement by the use of lime, which is generally found at a convenient distance.

The greater part of the country between the Blue Ridge and the Little North mountain, extending from the Potomac river up the valley about forty-five miles, was, when first settled by white people, a vast and beautiful prairie, with the exception of narrow fringes of timber bordering the water-courses. Wild animals were abundant; among which were the buffalo, the elk, the deer, the bear, the panther, the wolf, the fox, the beaver, besides various kinds of wild fowl. The first immigration to that part of the Great Valley was begun in the year 1732 by sixteen families from Pennsylvania, some of whom settled on the banks of the Opequan, and others on Cedar creek, south of the site afterwards chosen for Winchester, in Frederick county. Other settlers soon followed, and among them was a colony of Friends, mostly from Pennsylvania, who settled near the Opequan, and established a meeting at Hopewell.†

Higher up the valley the counties of Shenandoah and Rockingham were first settled by Germans from Pennsylvania, who were soon joined by European immigrants of the same language. They long adhered to their vernacular tongue and simplicity of manners, which are still retained in some families. Being industrious and skilful husbandmen, they have improved the natural fertility of the soil, and constructed ample barns and comfortable dwellings.

In the year 1736 Benjamin Burden obtained from Governor Gooch a grant of 500,000 acres of land, to be located on the head-waters of the Shenandoah

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* Professor J. L. Campbell, Southern Planter, vol. xx, No. 7.

† Kercheval's History of the Valley.

and James rivers. The following year he brought over from Ireland and Scotland one hundred families to settle on his lands. Most of them were Irish Presbyterians, who, being of Scottish extraction, were often called Scotch-Irish. The first party was soon followed by others of the same class, and these again drew others after them, until that part of the valley was filled with them and their descendants.

"From the German settlements upwards, to the vale of the James river, the population was generally Presbyterian, so that the whole mass, for sixty miles or more along the valley, was scarcely less homogeneous and peculiar than the mass of Germans below them."*

The counties of Augusta and Rockbridge comprise within their limits the settlement of Scotch Presbyterians, whose descendants, following the example of industry and sobriety left them by their fathers, continue to sustain a high reputation.

In the northeastern part of the valley, from the Potomac to the head-waters of the James river, the staple articles of culture are wheat and Indian corn, which are produced in great abundance; sheep husbandry and the grazing of cattle are also pursued to a considerable extent. From the James river to the southern boundary of the State tobacco is grown in most of the counties, and in some of them it claims a large share of attention. Nevertheless, the upper as well as the lower part of the valley may be considered a farming rather than a planting country, for grain is raised in large quantities, and grazing is a business of the first importance.

The mineral resources of the valley are very great. Bituminous coal and iron ore abound in the northeastern section, but some of the counties in that region, being now attached to West Virginia, do not come within the scope of this essay. The same valuable minerals are found in the southwestern section, particularly in Wythe county, which also enjoys the advantage of lead mines that were formerly worked with great profit. The discovery of lead at Galena Illinois, and in Missouri, situated more favorably for transportation by water than the lead mines of Virginia, has greatly impaired the value of the latter.

In Smyth and Washington counties, at the upper end of the valley, gypsum is found in great abundance, and has been advantageously used in agriculture. Saltville, in Wythe county, near the line of Washington county, is noted for the productiveness of the salt-works established there. In Featherstonhaugh's Geological Report, printed by order of the Senate in 1836. we find the following account of these works:

"In digging the first ten feet they go through a blackish loam which forms the surface of the whole valley, then twenty feet of blue and reddish clay, then thirty feet of clays very much intermixed with gypsum, and lower down to about two hundred and twelve feet, the greatest depth they have been obliged to go, for here the boring instruments drop into an unmeasured deposit of brine, through masses of gypsum, sometimes containing a little clay, and occasionally compact argillaceous laminæ, with ferruginous pebbles and pieces of sandstone. In the immediate vicinity of these settlements are extensive dry deposits of gypsum, where it is quarried for the use of the adjacent country. There are also others higher up the valley, nearer the sources of the Halstern. The average quantity of brine necessary to make a bushel of salt at Kanawha is said to be about seventy gallons, but at Saltville twenty-four gallons are sufficient to make one bushel, and this of the purest kind, there being no traces of muriate of lime in it, which is so troublesome at the other salt-works where the brine acts upon the calcareous rocks."

There are mineral springs in the valley that have attracted many visitors, and contributed to enrich the neighborhood where they are found. Jordan's White Sulphur Spring is in Frederick county, six miles northeast of Winchester. Its waters are said to resemble those of the celebrated White Sulphur Springs of Greenbrier.

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* Ruffner, quoted in Howe's History and Antiquities of Virginia, p. 453.

The Augusta Springs are twelve miles northwest of Staunton; the water is strongly impregnated with sulphuretted hydrogen.

The Alum Springs, in Rockbridge county, have become celebrated for the cure of diseases of the skin, scrofula, erysipelas, and dyspepsia. The water is tonic, alterative, and cathartic. The Bath Alum Springs are nearly of the same character.

The Warm Springs, in Bath county, have long enjoyed a high reputation, and been resorted to by numerous visitors. "While affording the most luxurious bath in the world, they contain neutral salts and various gases which act as a gentle aperient, diuretic, and sudorific, and give tone and vigor to the human system." The average temperature of the water is 98 degrees Fahrenheit; the bath is an octagon 38 feet in diameter, and 16 feet 9 inches inside; the water is five feet deep, and the cubic capacity 43,533 gallons; yet so copious is the stream that it will fill in an hour.*

The Hot Springs, five miles from the Warm, are noted for their baths, the temperature of the water being 106 degrees of Fahrenheit.

The Grayson Sulphur Springs, in Carroll county, are said to be efficacious for the cure of dyspepsia and rheumatism.

The Holston Springs, in Scott county, have the reputation of being similar in quality to the Greenbrier White Sulphur, which is the most celebrated of all the watering places of Virginia.

The most important town in the lower part of the valley is Winchester, in Frederick county, which, in 1860, had a population of 4,392, of whom 3,004 were white, 680 free colored, and 708 slaves. It has been a place of considerable business, and is the western terminus of a railroad leading to Harper's Ferry, connecting with the Baltimore and Ohio railroad.

Strasburg, Woodstock, and New Market, in Shenandoah county, and Harrisonburg, in Rockingham, are towns of considerable business, situated on the line of the Manassas Gap railroad, in a part of the valley which, before the war, was rich and populous.

Staunton, the county seat of Augusta, is 116 miles northwest from Richmond. Being situated in the heart of a well-cultivated country, with the Virginia Central railroad passing through it, this town enjoys a lucrative trade. The Western Lunatic Asylum, established here, is one of the most comfortable and best ordered establishments of the kind in America. Institutions for the blind and for deaf mutes are also situated here, and have afforded relief and instruction to large numbers of these interesting classes. The population of Staunton in 1860 was 3,875, of whom 2,865 were white, 110 free colored, and 900 slaves.

Lexington, the seat of justice of Rockbridge county, is beautifully situated in a rich and picturesque country. "The fine hills which rise on every hand, and sweep away so gracefully, are adorned by modern taste and architecture beyond most villages."

Liberty Hall Academy, now Washington College, was established by the Presbyterians in the early settlement of the valley. Having since been enlarged, and well endowed, it has become a flourishing and useful institution.

The Virginia Military Institute at Lexington had, before the rebellion, attained great popularity, but its influence has been detrimental to the true interests of the State. The population of Lexington in 1860 was 2,135; of whom 1,438 were white, 91 free colored, and 606 slaves.

Abingdon, in Washington county, and Wytheville, in Wythe county, are the most considerable towns in southwest Virginia. Situated on the Virginia and Tennessee railroad, they are the market towns for the surrounding country.

Emory and Henry College is ten miles from Abingdon. It was founded in 1838 under the patronage of the Holston Annual Conference of the Methodist Episcopal Church.

* Professor Rodgers, quoted in Howe's History, p. 185.

Population of the Great Valley of Virginia, according to the United States census of 1860.

Counties.	Whites.	Free colored.	Slaves.	Total.
Alleghany	5,643	132	990	6,765
Augusta	21,547	586	5,616	27,749
Bath	2,652	78	946	3,676
Botetourt	8,441	306	2,769	11,516
Carroll	7,719	31	262	8,012
Clarke	3,707	64	3,375	7,146
Craig	3,103	30	420	3,553
Floyd	7,745	16	475	8,236
Frederick	13,079	1,208	2,259	16,546
Giles	6,038	67	778	6,883
Grayson	7,653	52	547	8,252
Highland	3,890	27	402	4,319
Montgomery	8,251	147	2,219	10,617
Page	6,875	384	850	8,109
Pulaski	3,814	13	1,589	5,416
Roanoke	5,250	155	2,643	8,048
Rockbridge	12,841	422	3,985	17,248
Rockingham	20,489	532	2,387	23,408
Shenandoah	12,827	316	753	13.896
Smyth	7,732	183	1,037	8,952
Warren	4,583	284	1,575	6,442
Washington	14,096	249	2,547	16,892
Wythe	9,986	157	2,162	12,305
Total	197,961	5,439	40,586	243,986

Statistics of the Great Valley of Virginia, according to the United States census of 1860.

COUNTIES.	ACRES OF LAND.		Cash value of farms.	Live stock, value of.	Bushels of wheat.	Bushels of Indian corn.	Bushels of oats.	Pounds of tobacco.	Pounds of wool.	Pounds of butter.	Tons of hay.	Value of animals slaughtered.
	Improved in farms.	Unimproved in farms.										
Alleghany	26,360	86,852	$1,208,170	$161,153	21,657	115,482	54,624	88,340	4,095	44,745	1,209	$40,660
Augusta	224,644	213,515	10,997,286	1,287,615	307,402	752,530	191,379	40,727	35,810	451,305	21,687	254,383
Bath	37,605	148,540	1,455,351	187,823	15,311	71,371	26,608	3,575	12,015	44,345	2,015	37,716
Botetourt	76,096	145,082	3,415,045	380,728	162,676	231,892	106,539	875,459	12,184	135,030	4,603	108,333
Carroll	49,846	138,009	867,338	162,470	30,804	130,231	76,056	24,542	14,004	80,390	2,629	55,269
Clarke	83,209	24,390	3,645,185	335,667	330,153	252,205	53,205	1,000	31,248	67,905	3,126	70,913
Craig	24,577	46,382	942,745	124,926	20,001	66,619	32,230	32,922	6,862	31,554	1,969	29,841
Floyd	52,466	115,348	1,023,165	216,151	39,847	121,510	84,985	375,065	15,334	85,676	2,767	58,633
Frederick	116,117	74,356	3,987,945	519,296	224,471	285,770	85,241	832	37,936	215,758	7,777	96,524
Giles	49,015	108,746	1,760,806	257,222	54,874	184,785	46,101	99,592	14,275	64,767	1,816	66,180
Grayson	60,245	160,587	1,432,258	339,552	46,742	117,144	101,503	50,842	26,511	93,350	3,157	76,259
Highland	66,027	172,944	1,535,379	269,337	6,678	28,537	13,540	....	19,361	90,383	4,529	25,592
Montgomery	72,939	113,260	3,062,680	378,313	118,271	256,735	87,992	727,995	16,232	95,725	3,808	96,872
Page	58,431	63,600	2,192,549	286,509	102,149	175,168	21,384	47,138	12,624	86,918	4,104	71,447
Pulaski	59,003	114,446	2,337,220	288,451	69,676	202,910	30,930	141,662	15,387	70,652	3,232	83,230
Roanoke	58,306	133,079	2,323,226	254,689	175,013	152,803	81,813	935,341	8,056	54,071	3,097	59,857
Rockbridge	139,236	200,886	5,785,123	652,399	193,338	423,952	138,298	456,556	19,431	199,756	9,638	168,764
Rockingham	200,803	145,165	9,718,613	1,139,690	358,653	684,239	128,010	153,304	36,294	427,593	19,174	260,691
Shenandoah	76,641	88,910	4,035,255	366,153	172,292	195,778	45,289	....	13,755	134,827	6,455	83,204
Smyth	67,528	145,162	2,626,469	308,951	92,782	234,904	99,979	24,020	20,198	88,285	2,879	61,538
Warren	66,489	45,165	2,205,979	299,090	104,776	159,099	28,181	12,053	17,227	90,410	2,561	49,132
Washington	110,552	140,262	4,123,233	569,489	119,368	664,566	156,795	198,490	30,281	161,169	6,270	145,224
Wythe	110,879	163,234	3,793,227	411,815	90,485	301,368	117,788	43,644	30,514	163,996	6,544	124,374
Total	1,887,014	2,787,920	74,474,247	9,197,489	2,857,449	5,809,598	1,828,470	4,333,599	449,634	2,978,710	125,046	2,124,636

THE TRANS-ALLEGHANY REGION.

The trans-Alleghany region includes all the counties west of the Alleghany mountains, but since the organization of West Virginia only six of them are left in connexion with eastern Virginia, viz: Buchanan, Lee, Russell, Scott, Tazewell, and Wise. It is a mountainous region, well wooded and abundantly watered. There are many rich vales embosomed among the mountains, and many waterfalls well adapted for manufacturing purposes.

Iron, coal, and marble are found in abundance, but little has yet been done to develop the mineral wealth of these southwestern counties. The soil is excellent for grasses, and even on the steep mountain sides clover is found growing spontaneously. It is a fine grazing country, admirably adapted for raising cattle and pasturing sheep. In the production of maple sugar, butter, cheese, fruit, and home-made manufactures some of these counties excel.

Population of the trans-Alleghany region in Virginia, according to the United States census of 1860.

Counties.	Whites.	Free colored.	Slaves.	Total.
Buchanan	2,762	1	30	2,793
Lee	10,195	13	824	11,032
Russell	9,130	51	1,099	10,280
Scott	11,530	52	490	12,072
Tazewell	8,625	93	1,202	9,920
Wise	4,416	26	66	4,508
Total	46,658	236	3,711	50,605

Aggregate population.

Counties.	Whites.	Free colored.	Slaves.	Total.
Tide-water region	229,108	36,763	192,271	458,142
Piedmont region	218,140	12,831	235,926	466,897
Great Valley	197,961	5,439	40,586	243,986
Trans-Alleghany	46,658	236	3,711	50,605
Total	691,867	55,269	472,494	1,219,630

Statistics of the trans-Alleghany region of Virginia, according to the United States census, 1860.

COUNTIES.	ACRES OF LAND. Improved in farms.	ACRES OF LAND. Unimproved in farms.	Cash value of farms.	Value of live stock.	Bushels of wheat.	Bushels of Indian corn.	Bushels of oats.	Pounds of tobacco.	Pounds of wool.	Pounds of butter.	Tons of hay.	Value of animals slaughtered.
Buchanan	10, 262	181, 383	$229, 981	$68, 248	5, 164	57, 975	9, 126	2, 365	3, 359	32, 510	11	$15, 501
Lee	72, 405	170, 192	2, 768, 021	447, 142	49, 993	582, 648	97, 991	38, 162	19, 056	100, 995	891	96, 396
Russell	93, 066	119, 117	2, 324, 483	416, 824	56, 178	327, 197	100, 869	7, 805	30, 421	135, 940	1, 466	89, 264
Scott	73, 693	226, 155	2, 085, 722	425, 280	62, 357	512, 820	93, 182	16, 773	22, 107	87, 723	1, 025	101, 055
Tazewell	65, 722	273, 251	2, 878, 107	485, 525	44, 619	206, 320	97, 421	12, 470	25, 830	100, 720	3, 486	74, 772
Wise	21, 181	175, 425	506, 618	123, 250	11, 108	115, 925	19, 458	2, 300	6, 768	42, 833	192	33, 186
Total	336, 329	1, 145, 523	10, 792, 932	1, 966, 269	229, 419	1, 802, 885	418, 047	79, 875	107, 541	500, 721	7, 071	410, 174

SECTIONS.	AGGREGATE.											
Tide-water	2, 698, 873	3, 009, 347	$77, 906, 005	$9, 379, 215	3, 137, 221	11, 536, 636	2, 138, 853	16, 650, 831	273, 070	1, 620, 980	63, 043	$2, 872, 539
Piedmont	4, 169, 478	4, 186, 168	121, 063, 340	14, 957, 466	4, 603, 850	11, 251, 224	4, 072, 320	100, 724, 131	606, 607	3, 603, 634	87, 903	3, 958, 818
Valley	1, 887, 014	2, 787, 920	74, 474, 247	9, 197, 489	2, 857, 449	5, 809, 598	1, 828, 470	4, 333, 599	449, 634	2, 978, 710	125, 046	2, 124, 636
Trans-Alleghany	336, 329	1, 145, 523	10, 792, 932	1, 966, 269	229, 419	1, 802, 885	418, 047	79, 875	107, 541	500, 721	7, 071	410, 174
Total	9, 091, 694	11, 128, 958	284, 236, 524	35, 500, 439	10, 827, 939	30, 400, 343	8, 457, 690	121, 788, 436	1, 436, 852	8, 704, 045	283, 063	9, 366, 158

The foregoing tables of farm products relate to such only as are deemed staples; others of less value, or not so generally cultivated, are enumerated below, viz:

Statement of the farm products of Virginia not included in the preceding tables.

Ginned cotton, bales of 400 pounds	12,602
Rye, bushels of	873,067
Peas and beans, bushels of	483,836
Rice, pounds of	7,062
Irish potatoes, bushels of	1,545,792
Sweet potatoes, bushels of	1,892,736
Barley, bushels of	8,478
Buckwheat, bushels of	135,572
Orchard, value of products	$566,377
Wine, gallons of	38,440
Value of produce of market gardens	$545,168
Cheese, pounds of	159,267
Clover-seed, bushels of	29,732
Grass-seed, bushels of	42,492
Hops, pounds of	7,006
Hemp, pounds of	27,944
Flax, pounds of	304,310
Flax-seed, bushels of	24,261
Silk cocoons, pounds of	156
Maple sugar, pounds of	270,925
Maple molasses, gallons of	28,180
Sorghum molasses, gallons of	96,952
Honey, pounds of	1,008,232
Beeswax, pounds of	64,411
Value of home-made manufactures	$1,073,956

Statement of live stock in Virginia, from the census of 1860.

Horses	201,717
Asses and mules	39,341
Milch cows	230,559
Working oxen	79,176
Other cattle	424,643
Sheep	589,935
Swine	1,272,705

Statement of the products of the mines in Virginia, according to the census of 1860.

Gold:	Value
Fauquier county, 1,200 pennyweights	$1,200
Spottsylvania county, 9,000 pennyweights	10,000
Stafford county, 22,500 pennyweights	25,000
Copper:	
Carroll county, 1,693 tons	35,500
Fauquier county, 90 tons	9,000
Lead:	
Wythe county, 580 tons	61,000

Manganese:

Augusta county, 350 tons	5,250

Coal:

Henrico county, 10,000 tons	20,000
Chesterfield county, 102,000 tons	285,000
	451,950

Statement of the iron manufactures in Virginia, according to the census of 1860.

Counties.	Tons of pig iron.	Value of pig iron.	Tons of bar-iron.	Value of bar-iron.
Alleghany			87	$8,700
Augusta	800	$16,000	46	5,000
Botetourt	1,200	48,000		
Franklin	200	6,000	90	9,000
Lee			6	600
Loudon	2,250	58,000		
Page	75	1,875	95	9,500
Patrick	500	12,500		
Rockbridge	2,800	76,500	165	16,500
Shenandoah	2,481	57,098	347	28,060
Smyth			10	1,000
Warren			100	10,000
Wythe	700	20,800	222	22,650
Henrico, Tredegar works, Richmond			6,000	500,000
Henrico, Tredegar works, machinery				500,000
Total	11,006	296,773	7,168	1,111,010

Statement of the cotton manufactures of Virginia, according to the census of 1860.

Counties.	Establishments.	Capital invested.	Cotton, pounds.	Value of annual products.
Alexandria	1	$60,000	400,000	$100,000
Albemarle	2	30,300	276,000	51,560
Chesterfield	5	866,700	4,827,000	938,400
Dinwiddie	2	227,000	694,600	141,600
Fluvanna	1	30,000	225,000	34,000
Isle of Wight	1	35,000	175,000	32,000
Mecklenburg	1	300	2,000	600
Stafford	1	28,000	300,000	42,000
Total	14	1,277,000	6,899,600	1,340,160

Statement of the woollen manufactures of Virginia, according to the census of 1860.

Counties.	Establishments.	Capital invested.	Value of annual products.
Albemarle	2	$4,300	$10,190
Amherst	1	1,000	1,440
Augusta	6	49,400	39,620
Bath	2	1,200	2,950
Bedford	2	2,000	3,750
Botetourt	1	5,000	9,000
Campbell	1	1,500	12,000
Carroll	2	1,800	4,384
Culpeper	2	42,500	124,000
Fauquier	3	35,250	53,640
Fluvanna	1	500	2,300
Floyd	1	2,600	2,000
Franklin	5	2,950	9,900
Frederick	7	36,500	55,460
Green	1	300	1,600
Henrico	1	130,000	200,000
Loudon	3	12,000	16,500
Louisa	1	2,500	1,520
Prince William	2	23,000	23,890
Pulaski	1	300	2,000
Roanoke	1	20,000	21,000
Rockbridge	3	6,450	7,120
Rockingham	1	12,000	15,000
Russell	1	700	5,650
Washington	7	8,200	13,105
Total	59	401,950	638,019

Statement of the tobacco manufactures of Virginia, according to the census of 1860.

Counties.	Number of establishments.	Value of annual products.
Albemarle	1	$45,000
Bedford	11	246,292
Campbell	47	2,081,149
Chesterfield	2	170,000
Dinwiddie	20	2,167,202
Fluvanna	3	56,000
Franklin	17	305,750
Frederick	1	1,330
Halifax	2	34,900
Henrico	52	4,838,995
Henry	28	349,600
Louisa	10	254,910
Mecklenburg	5	295,000
Patrick	7	55,930
Pittsylvania	39	1,031,544
Prince Edward	5	173,831
Roanoke	3	46,750
Spottsylvania	1	25,000
Washington	1	10,000
Total	255	12,189,183

Through the courtesy of Joseph C. G. Kennedy, Superintendent of the Census, the foregoing statistics, relating to Virginia, have been obtained in advance of their publication.

The manufacture of flour, one of the most important in the State, having been imperfectly returned, is here omitted.

The aggregate value of manufactures in Virginia when the last census was taken is said to have been about fifty millions of dollars.

It is to be regretted that the census returns relating to the shad and herring fisheries and the oystering business in this State are so defective that we cannot give even an approximate estimate of their immense value.

FRUIT-GROWING.

The following abstract of a communication from Yardley Taylor, an experienced pomologist of Loudon county, Virginia, is deemed appropriate for insertion here.

It was formerly supposed by many that fruit-growing could not be successfully followed in eastern Virginia, but there is no sufficient reason for such a conclusion, the soil and climate being well adapted to that purpose. The only requisites to insure success are proper cultivation and the selection of suitable varieties.

In the growing of Indian corn we find it best in Virginia to select a different variety from that which is planted in the northern States, and it is obvious that the same discrimination is required to secure success in fruit-growing. The improvement of fruits in this country was first successfully attempted in the

northern States, and persons living in Virginia, who desired to share the benefits of that culture, have too generally depended on the north for their varieties, not considering the difference of soil and climate. It has been found by experience that very few varieties will suit all parts of this country. All kinds of fruit require a certain degree and continuance of heat to bring them to perfection, and on this depends, in a great measure, the time required for their growth and ripening. They require more time on a high mountain than in a valley in the same latitude. Northern winter fruit brought to Virginia will ripen earlier and become fall fruit. A few years ago we obtained cuttings from most of the famed fruit trees and vines of the north, and now have many of them in bearing. The famous Northern Spy apple, so valued in western New York, ripens here the latter part of October. In thus transplanting to a milder climate the quality of the apple is often improved, but its keeping qualities are impaired.

It was not until within a few years past that good varieties of fruit could be obtained from the south. During Jefferson's administration, when the Choctaws, Cherokees, and other Indians were living in upper Georgia, East Tennessee, and the northern part of North Carolina, the Indian agents were instructed to encourage them to plant orchards, which they did by first planting apple seeds. Among the vast number of seeds planted some superior varieties were produced, and these having been selected for cultivation, southern pomologists say they now have apples that for flavor and keeping qualities are equal to those of the north.

Many of these varieties would probably succeed well in eastern Virginia, for we find it stated in the Patent Office Report that the line of equal temperature which passes near Norfolk continues near the southern line of Virginia, and then turns south around the mountains, passing through the region where many of these varieties originated.

The improvement of the soil in most localities is another indispensable requisite for successful fruit-growing. The application of lime and ashes is generally very beneficial, and for wet soils under-draining is necessary.

In selecting fruit trees for planting, it is found that the apple and the pear do best when two years old from the graft, and the peach when one year old from the bud. The planting should be done with great care, and the orchard should be cultivated in hoed crops for several years, care being taken not to disturb the surface roots. Grain should not be grown in the orchard, and after the trees have stood a few years they alone should have the full benefit of the soil with proper cultivation.

The peach succeeds well in Virginia. It is not unusual here to see peach trees thirty or forty years old. The lands lying near the upper part of Chesapeake bay, in Maryland and Delaware, are found adapted to peach-growing, and vast orchards have been planted there for supplying the northern market. The tide-water region of Virginia is doubtless equally well adapted to the same culture.

Grape culture is now attracting much attention throughout the country, and there is every reason to suppose that it will succeed well in Virginia if judiciously pursued. Indigenous grape-vines flourish well, and bear abundantly in the Piedmont and tide-water regions of Virginia. Travellers from foreign lands, who have visited most parts of the United States, have noticed the peculiar adaptation of these sections to the growth of the vine. Some years ago a Frenchman named Monare, who had seen the vineyards of our northern and western States, visited a part of the tide-water region of Virginia, where he was strongly impressed with the abundance of the native grape-vines and their luxuriant growth, as well as the adaptation of the soil and climate to grape culture. He then determined to invite a colony from his native country to settle on a tract of land bordering on the Potomac river, below the mouth of the Occoquan, which he selected as being well adapted to his purpose. Before his arrange-

ments were completed he was removed by death, and his proposed colony, from which much benefit was anticipated, was never established.

In the Piedmont region several small vineyards have been successfully cultivated, and it is confidently believed that on the eastern slope of the Blue Ridge, as well as on other mountain ranges in eastern Virginia, advantageous locations for grape culture will be found.

Many attempts have been made to introduce foreign varieties of the grape into this country, but it has been generally found that they are not adapted to outdoor culture. Native varieties have within a few years past been very successfully cultivated, and some of them are found to flourish and bear well in Virginia. The Catawba has been most generally grown, but the Delaware and the Clinton are more hardy, and in unfavorable seasons succeed better than most others. In point of flavor the Delaware grape stands highest, the vine grows well, and the berry is smaller than many others. The Clinton is a strong grower and heavy bearer, rarely affected by disease, and is said to make good wine. The Concord is a large grape, and sells well; its quality has been improved by transplanting to Virginia. Rogers's Seedlings are much commended, and thus far have succeeded well. They were produced by hybridization, thus combining the flavor of foreign varieties with the hardihood of our native vines.

Grape culture succeeds best in a moderately loose soil, which should be well drained, for too much moisture keeps the surface cold. In the tide-water region of Virginia, wherever the soil has been impoverished, the application of marl and other fertilizers will be found highly advantageous.

In the lower section of the Piedmont region the soil is naturally well adapted to fruit growing, but some of it having been impoverished needs improvement. In the upper section of this region the strata of rocks having been broken and tilted up, allows the water to penetrate the earth, and there is little need of under-draining. Here fruit culture has been very successful.

The limestone lands of the valley are generally superior to any other part of the State for the production of the apple, though not equal to the eastern section for the growth of the peach. There is no reason to doubt that some of the most elevated limestone lands of this region would be found as well adapted to fruit-growing as the celebrated orchards on the Hudson.

EDUCATION.

The most important institutions of learning in the State are the University of Virginia, in Albemarle county; William and Mary College, in James City county; Hampden Sydney College, in Prince Edward; Randolph Macon College, in Mecklenburg; Washington College, in Rockbridge; and the Episcopalian Theological Seminary, in Fairfax, near Alexandria. Besides these institutions, there are in the State many academies and schools, male and female, some of which are incorporated. But it must be acknowledged that the education of the people has been deplorably neglected.

In the year 1845 a great interest in popular education was awakened in Virginia, and a convention of delegates from fifty-one counties and cities met at Richmond to deliberate on the means of improving the school system of the State. The startling fact, revealed by the census of 1840, that there were in the Commonwealth 58,787 white persons above the age of twenty years who could not read or write, being one-twelfth of the whole white population, or one-sixth of the adults, was considered disgraceful to the State, and an evil that should be remedied. The establishment of district free schools was recommended by the convention, and the legislature, being then in session, immediately passed a law for that purpose, to be submitted to a vote of the people, and applied to such counties as were willing to receive it. There was at that time a literary fund of about a million and a half dollars, the income of which

was devoted to educational purposes, part of it being appropriated for the support of colleges, and the remainder divided among the counties to pay for the education of *poor children*. By the proposed school law most of this fund was to be applied towards the free schools, and the further revenue required for their support was to be raised by county taxation. The law, from which so much good was anticipated, was adopted only in six counties, and proved but a partial benefit. The chief causes of its rejection in the other counties were the apathy and prejudice of the laboring classes, whom it was intended to benefit, and the jealousy of the slaveholders, who covertly hinted that it would be "an entering wedge for something else," meaning that it would endanger the "peculiar institution of the south." There were, however, honorable exceptions among the slaveholders, some of whom evinced a patriotic desire to promote the general education of the people. In all counties a large proportion of the aristocratic class view with jealousy the elevation of the masses, being apprehensive that their own privileges will be abridged by the general diffusion of light and liberty.

Although the literary fund was subsequently augmented, it is believed that the state of education was but little improved. The census of 1850 shows that the number of white adults in the State who could not read and write was 77,005, being more than one-twelfth of the whole white population. When we take into consideration that, in addition to the uneducated among the white population, there were in the State 490,865 slaves, most of whom were deplorably ignorant, it presents a picture distressing to contemplate.

PRESENT CONDITION.

The population of Virginia has considerably diminished since the commencement of the rebellion, but the extent or ratio of decrease cannot at present be determined. In the counties between the Rappahannock and the Potomac—formerly called the Northern Neck—a very large proportion of the slaves have embraced the opportunity to throw off their fetters and seek for freedom within the Union lines. The same result has taken place in counties bordering on Chesapeake bay that are contiguous to the Union forts or armies.

Many of the free colored people, fearing that they would be impressed into the rebel service, have sought homes in the free States, and an emigration of the white population from the border counties has been in progress from the commencement of the war. This has been greatly accelerated by the relentless conscription ordered by the insurgent government, which has drawn into the vortex of rebellion many who were opposed to secession, and has caused thousands to seek for safety within the Union lines. In addition to these causes of depletion, there has undoubtedly been, from the casualties of war, an enormous loss of life, spreading bereavement and distress on every hand.

The destruction of property and stagnation of business that have ensued, though less deplorable than the waste of population, is a calamity most severely felt throughout the State.

The blockade of every port occupied by the insurgents has paralyzed commerce; the marching of great armies through the State has laid waste some of the fairest portions of her territory; and the withdrawal of labor from productive occupations to engage in the conflict of arms has produced exhaustion. In every neighborhood where armies have encamped for any length of time the fences are destroyed and the forest trees cut down for miles around.

In a country thus impoverished and distracted it could not be supposed that much attention would be given to education; and we accordingly find that the schools and academies are languishing or suspended, while the literary fund, that was necessary to their support, has been absorbed by the insatiate demands of war.

The effect of the rebellion on the finances of the State has been most disastrous, and her public credit, which once stood so high, is seriously impaired. But there is every reason to believe that when peace shall be restored she will honorably acknowledge and ultimately redeem her bonds issued before the war.

A civil government, composed of a governor, senate, and house of delegates, representing the loyal sentiment of about ten counties in Virginia, now meets at Alexandria. A convention, representing the same counties, met in that city last winter and revised the State constitution, introducing into it an article for the abolition of slavery, and another for the establishment of free schools. These salutary measures, however, cannot be carried into effect until the supremacy of the federal government is restored.

THE FUTURE.

Having shown what Virginia was before the rebellion, and briefly adverted to the disastrous effects of civil war upon her agriculture, commerce, and population, I now propose to consider the consequences that must ensue upon her restoration to the Union, with the incubus of slavery removed, which has hitherto paralyzed her energies and obstructed her progress.

A glance at her vast natural resources is sufficient to show that she is destined to be one of the most populous and prosperous States in the Union, and that she may even regain the precedence which she held at the beginning of our national career.

Her tide-water region has in the port of Norfolk one of the best harbors in the world. She has many navigable rivers, and shares with Maryland the majestic Potomac, which affords an avenue for commerce extending into the interior nearly two hundred miles from the coast, and floating large ships to the Washington navy yard, and to the beautiful port of Alexandria.

The water power supplied by the falls of the Potomac, of the Occoquan, of the Rappahannock, of the James, and of the Appomattox rivers, is capable of driving a vast amount of machinery; and its value is enhanced by its proximity to navigable water. The oyster-beds of the Chesapeake, and the shad and herring fisheries on the rivers tributary to it, are of inestimable value.

The alluvial soils on the river banks are admirably adapted to market gardening, and the products may be carried thence by water to the northern cities, as they have been from the county of Norfolk.

On the more elevated lands in the same region native grape-vines grow luxuriantly, showing the adaptation of the soil and climate to grape culture. Peach-trees there live longer and grow larger than they do in more northern latitudes, and doubtless their culture may be made a lucrative branch of business. There is in this section some good farming land, and even the exhausted soils may be made productive by the application of lime and marl. By this means, it is said, seventeen millions of dollars were added between the years 1838 and 1850 to the assessed value of land in the tide-water district.*

In the Piedmont region the productiveness of the soil, the numerous springs of pure water, and the admirable adaptation of the country to farming, grazing, and sheep husbandry have been sufficiently demonstrated. The last census shows what has already been done in Loudon county, and we may reasonably conclude that even more can be accomplished in other counties similarly situated when brought under the influence of free labor and skilful management. Fruit culture succeeds well in this region, the soil and climate being adapted to the

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* Southern Planter, Vol. XX, No. 7. Address of Edward Ruffin before the South Carolina Institute, 1852.

apple, the pear, the peach, and the grape. On the Blue Ridge and the Catoctin mountain fruit is seldom injured by frost.

The Great Valley of the Shenandoah, being already celebrated for its fertility and beauty, needs no commendation. The census returns from Jefferson, Shenandoah, Rockingham, Augusta, Rockbridge, and some other counties, show an affluence of production that will bear comparison with that of any agricultural district in the Union.

The climate of Virginia is salubrious. According to the United States census, the mortality in this State in the year 1850 was less than the general average throughout the Union; and in 1860 it was rather greater than the general average. Some parts of the lowlands in the tide-water country are subject to fever and ague in autumn, but it is believed that only a small portion of that region is liable to this objection.

In the Piedmont region the country is hilly, the streams pure and rapid, and there appears to be no local cause to generate malaria. The Great Valley partakes very much of the same character, and the trans-Alleghany region is proverbially healthy.

The mildness of the climate in the eastern part of the State renders a winter residence there very desirable. Families from the north, who removed some years ago to Fairfax and other contiguous counties east of the Blue Ridge, found an improvement of health from the genial and pure atmosphere.

Many persons from the north and west, who have passed through Virginia in the military service of the Union, being very favorably impressed by the beautiful scenery, fertile soil, and mild climate, have expressed a determination to seek a residence here when peace shall be restored and slavery abolished. A great increase of population may then be expected; for such has been the effect of emancipation in other States.

Maryland, which has so recently become a free State, already begins to feel the stimulating effect of her new position. Capitalists and agriculturists from the north are investing in her once neglected lands; the value of property is advancing; and her loyal citizens look forward to a prosperous future. Under her revised constitution education will receive a new impetus, and treasures of intellect, more valuable than material wealth, will be developed.

West Virginia has started on a new career of improvement, notwithstanding the difficulties imposed on her by incursions of the insurgents.

While desiring an increase of population from other States, we should by no means undervalue the capabilities of native Virginians. They have evinced in their disastrous contest with the federal government a high degree of energy and endurance, which, had it been devoted to the promotion of our national prosperity, would have entitled them to lasting honor. In the border counties a large number of citizens have steadily maintained and avowed their attachment to the federal Union, while in the interior this sentiment undoubtedly exists to a considerable extent, but its expression has been in a great measure suppressed by the stringent measures of the insurgents. May we not hope, when peace shall be restored, with universal freedom, that useful labor will be held in greater esteem, and that those talents and energies which heretofore have too often been devoted to fruitless contests and inglorious pursuits, will be employed in promoting the progress of agriculture, commerce, manufactures, literature, and science? The moral and religious condition of our population may then be improved, for it is obvious that nothing tends more to demoralize a community than the habits acquired by a large proportion of those who go forth to engage in the conflict of arms, leaving behind them the refining influences that cluster around the domestic hearth and adorn the social circle. The conditions now required for the prosperity and happiness of the Old Dominion are the restoration of the national authority and civil law, peace, free labor, and free schools.

CULTURE AND MANAGEMENT OF FOREST TREES.

BY JNO. J. THOMAS, UNION SPRINGS, NEW YORK.

No people have ever equalled the Americans in boldness of enterprise and active industry. They have, within a comparatively brief period, levelled the forest and let in the sun on many thousand square miles of territory, built cities, opened canals, made railroads, and formed a powerful and prosperous nation. Unfortunately their enterprise has not been always sufficiently discriminating. The original necessity of sweeping off the forest has imparted to many a propensity for cutting and slashing which has not stopped within reasonable boundaries.

The rapid disappearance of our forests should excite the serious attention of land owners generally. During a ride through a portion of country that I had well known twenty years ago, but had not seen in this interval of time, I was struck with the havoc that had been made in the woodlands. A dense fifty-acre wood-lot in particular had been so reduced on every side by its three owners that only a small portion remained, and this portion was so thin that close pasturage grew in every part. The wasting away which was so strikingly visible appeared to be mainly the result of the home consumption of ordinary fuel. In the same neighborhood a land owner pointed out to me over one hundred acres of land, once densely covered with timber, but now entirely cleared for the sole purpose of supplying his own family with fire-wood during the forty years he had resided there. Many farms have thus become nearly, and others entirely stripped of their woodlands. Where the timber has been cut for sale for the supply of towns, factories, steamboats, and railways, the devastation has been more rapid.

The same results in a greater or less degree may be found almost everywhere. It has been estimated that, at the present rate of consumption of the lumber districts of the country, the whole region east of the Mississippi will be stripped of everything valuable for this purpose within the next twenty or thirty years.

What expedient shall we then resort to for procuring materials for fencing and farm buildings? Where will timber be obtained for the construction of agricultural implements and machines of all kinds; for bridges; for the construction of steamboats and ships; to say nothing of the three or four thousand cords now annually consumed for fuel in every township throughout the settled portions of the country? Many farmers, indeed, may resort to the use of coal, but the great majority will be many miles from canals and railroads, and will be compelled to draw it long distances, in addition to paying its full price. The crisis must be met within the coming half century. The planting and growth of young forests to prevent this rapid waste should take place immediately. The growth of the new plantations will be needed quite as soon as sufficient size can be attained.

This question, therefore, assumes the highest magnitude. The cultivation and growth of trees is not second in importance to that of the other great interests of the land owner. But little attention at large is, however, as yet given to it. The wheat crop, the corn crop, the breeding and raising of domestic animals, and the other departments of successful agriculture, are constantly urged upon the public attention.

If the growth of timber trees is much longer neglected it will force itself upon the minds of farmers and manufacturers when the inconvenience of entire exhaustion cannot be easily remedied.

SHELTER TO THE LAND.

One of the most important advantages secured by tree-planting is shelter to the lands from the sweep of winds. Wall protection is well known to gardeners, and every skilful horticulturist is aware that tender plants will survive severe winters when surrounded or overshadowed by evergreens. The experiment of Frederick Tudor, at Nahant, in converting a barren piece of land exposed to sea blasts into a fertile and productive garden, by the screen of high fences, is well known. Exposed surfaces, over which the cutting winds of winter sweep freely, are injuriously affected in many ways. The snow, which should form a protecting mantle, is swept off into drifts, and the bare earth subjected to the full action of the hardest frosts. Young plants of grass and winter grain, after being heaved up by intense freezing, are beaten about, and often actually torn out by the action of the strong wind upon them. This every observant farmer must have seen. But winter is not the only season of injury. Sweeping tempests beat down grain fields, level the heavy grass of meadows, and break and injure young half-grown fields of corn. Young and newly planted orchards are severely frozen, whipped about, destroyed, and dried up by the blasts which, for several winter months, sweep over them.

These evils may be avoided, and the important advantage of a supply of timber secured at the same time, by planting belts of trees, or by leaving these belts on new land when it is cleared. If the land is nearly level the belts of timber should be at regular distances of sixty to eighty rods apart, and they should be at least four rods wide, and may be eight or ten. They should run in such a direction as to afford the best shelter from prevailing winds. If the land is more or less hilly, discretion must be used in placing these belts, and more irregularity in their position will be necessary. They may, perhaps, be allowed to occupy a hill-side, the borders of a ravine, or other irregular surface which cannot be advantageously tilled. These belts should be kept fenced on both sides, and cattle excluded so as to allow the thick growth of young trees, which will render the screen more perfect, and afford a succession as the older trees are cut away for timber and fuel. Every farmer needs a certain amount of reserved woodland; and it may be as well reserved in this advantageous shape as in one that, from its position, shall be of no benefit to the land. On small farms, one single belt, of such a width as may afford the necessary wood for use, judiciously located to protect the farm, may be sufficient; on large ones they should be at regular intervals.

Where a broad area of land has been already cleared these belts may be planted, and will afford good protection after a lapse of comparatively few years; and as the best kinds may be selected, the timber may prove eminently valuable. There is, perhaps, no kind of tree that promises so much profit as the locust, even with the occasional danger of injury by the borer. They will often grow fifty feet high in twenty-five years if planted closely. Less valuable for timber, but very rapid growers, are the chestnut, the common elm, the silver maple, the European larch, and the Norway fir; with some of these on rich lands, screens thirty feet high may be had in ten years. The silver poplar exceeds all in rapid growth, but its wood is worth but little. On our western prairies, where the severe and constant winds are found to be a most serious evil in many respects, and a large drawback on successful farming, there is no question that these effects might be astonishingly softened by artificial timber belts, which a very few years on a fertile soil would amply furnish.

Isaac Pullen, a well-known nurseryman at Hightstown, New Jersey, showed

me last summer several belts of evergreens which had sprung up from his nursery rows to a height of above twenty-five or thirty feet in ten years; and he stated that within the shelter of these screens his nursery trees, as well as farm crops, averaged fifty per cent. more than on bleak and exposed places. I have known an ordinary English thorn hedge, which had been allowed to run up without shearing twenty feet or more in height, to shelter and save from winter-killing a crop of wheat as far as its influence extended, while beyond this the grain was nearly destroyed; yet this narrow hedge, only a few feet in thickness, formed a very imperfect screen when compared to a mass of trees several rods in breadth. Another important advantage has been occasionally afforded by the shelter of woodlands. It is well known that *rust* in *wheat* is commonly most prevalent on low and mucky lands; yet at other times, and in its most virulent form, it seems borne on the wind, and often destroys thousands of acres on all kinds of soil in one sweeping blight. An instance of this sort occurred in northern Indiana in 1840. Early and late sown, on compact and spongy soil, on hill and dale, cleared land and prairie, were all alike affected. In every instance, however, where the crop was sheltered by woodland it was least injured. An extensive farmer of Ontario county, New York, informed me, some years ago, that out of two hundred acres of promising wheat which he then had growing, all was completely destroyed except *those portions sheltered by woods;* the total loss being four or five thousand dollars, most of which he believed would have been saved had his land been protected in the manner we have described.

MODES OF PLANTING.

There are different modes of starting the young trees of a timber plantation. One is by sowing the seed broadcast where the trees are to grow. This is usually a very uncertain mode, as the seedlings cannot be subjected to cultivation and are liable to be overgrown with grass and weeds. The most successful mode of obtaining a broadcast growth from seed is to burn over the whole surface of a recently cut forest in autumn, and then scatter the seed over this surface. The burning will commonly destroy such growth as would be undesirable, and the scattered seeds of the trees will take ready root in the fresh and mellow surface. Another mode extensively adopted in Europe is to raise the seedlings in seed beds, afterwards to remove them to nursery rows, and when large enough to set them out in plantations in a manner similar to that of planting orchards. This method succeeds well if performed on good land which has been deeply ploughed or subsoiled. It is, however, attended with considerable expense, but is cheaper than the more hasty and superficial practice of setting the trees in hard and unprepared ground where but little growth can be made, and where many of the trees die of neglect, and leave thin, uneven, and unthrifty plantations of crooked trees.

Where trees are transplanted to form plantations it should be done in rows where they can receive regular cultivation for a few years. The growth which they will make under such treatment will be many times greater than under neglect. This fact is familiar to experienced orchardists who have seen the effects of cultivation on young peach-trees producing annual shoots three to four feet long, while others, standing in grass or hard ground, have scarcely made a growth of as many inches. This difference is not so great in the apple, cherry, or pear, but it may be laid down as an average rule that a clean surface and mellow cultivation will at least triple the growth in any case while the trees are yet small, and frequently produce an increase of eight or ten fold. In other words, the young trees under the best management will be as large in three years as they would otherwise in nine years or more. When the land is valuable it is obvious that the management which gives the quickest growth and

the heaviest return of timber within a given time will prove the most remunerative and profitable.

The practice is common in Europe of selecting hill-sides and irregular surfaces, and planting the trees without regard to rows over the whole surface, as no cultivation can be given them. It would be better, however, both for facilitating regular thinning, and for passing between the rows for removing the timber when cut, to plant in rows.

On more level land, where cultivation can be given, the young trees should be transplanted in the quincunx or, more correctly, hexagonal form, thus allowing the cultivator to pass among them in three different directions, and giving more external beauty to the plantation. On such surfaces as do not admit of cultivation, it is very important to set the trees out thickly enough at first, say four or five feet apart, to shade the ground. The fallen leaves will form an annual mulching, and they will protect each other against the effect of winds. It has been found that young trees thus covering the surface will succeed and flourish, while single trees set out in exposed situations would grow feebly or perish.

In transplanting these young trees the importance cannot be too strongly urged of taking them up with a large amount of small fibres on the roots, and to perform the transplanting in the best manner by spreading out all these fibres with the fingers, while the hole is filling with fine, mellow earth, instead of crowding them together by carelessly shovelling in the soil, and leaving interstices among the roots.

Trees which grow directly from seed without transplanting are commonly thriftiest, straightest, and best. Their tap-roots extend deeply into the soil, and they soon obtain a strong foothold. Transplanted trees, on the contrary, require some years to become well established, and to assume a vigorous state of growth, unless they have been set out when quite small or not more than three or four feet high. If the soil is in good condition, and is kept well cultivated, these smaller trees will not only outstrip larger transplanted ones, but will make a better and more valuable growth. If young trees, transplanted or otherwise, are feeble, or have a crooked form, it will be found of great advantage to cut them down, and allow fresh, vigorous, and young shoots to spring up in their place. This cutting down should be done in winter or very early in the spring, and never after the growing season has commenced, for nothing tends more to check the growth of a tree than severe pruning after the buds have expanded or while in a growing state.

PLANTING THE SEED AND CULTIVATION.

As the labor and expense of transplanting would be considerable on an extensive scale, and as some kinds of trees are difficult to transplant successfully, such, for example, as the chestnut, hickory, and tulip tree, it has been found cheaper and better to plant the seeds where the trees are to remain, in the following manner:

Prepare the ground for corn, potatoes, beans, or other hoed crop, as early in the spring as practicable. Plant the seeds of the trees in rows or hills at proper distances, as hereafter explained, and afterwards plant the crop in the spaces between. The cultivation to which the latter must be subjected will promote the rapid advancement of the trees. A continued cultivation for a few years by alternating the root crops, corn, and beans, will give the trees sufficient size as to require no further attention of the kind; and their shade, with the mulching of the leaves which fall from them, will be sufficient to prevent intruding growth.

As the seeds of forest trees sprout very early in spring, it may be necessary to perform the planting in the autumn on such soils as cannot be worked the moment that the frost disappears from the ground. The rows thus planted

should be carefully left undisturbed in reploughing the ground between them for the annual hoed crop.

This mode of management renders the commencement of a timber plantation a matter of comparatively little labor and expense, the crop raised between the rows more than paying for the whole. Or the seeds of the trees may be planted with the view of covering at once the whole ground, without the intermixture of any of the ordinary hoed crops, by placing them at distances of four or five feet apart each way, and subjecting them to a cultivation similar to that of a corn crop. Plenty of seed should be placed in each hill, so that, in thinning out, the best tree may be left. This mode would give a quick growth, and the large amount of young trees, which in a few years would be required to cut out, would doubtless well repay the extra cost and trouble. Another mode of obtaining a young plantation, and by far cheaper than any other, is to allow the spontaneous growth which springs up from the clearing of the previous forest to take its own course. To facilitate this end, it has been found best not to cut out or thin the previous forest, merely leaving the smaller trees to grow, but to clear off entirely the whole surface, cutting every tree to the ground. A new, even, and dense growth will be the result, in place of one that is scattered, and rendered feeble by the shading of the trees which have been left. Hence, in cutting away the timber from all woodlands this clean sweep should always be made, as far as the required supply of timber renders it necessary, in order that the new growth may spring up in its place; the only exception is the cutting out from the woods of such old and decaying trees as will grow worse instead of better. But there is one prominent disadvantage in this mode of obtaining a wood plantation: the trees being promiscuously mingled, and not in straight rows, it will always be more or less difficult to drive wagons among them in drawing out the timber—a difficulty greater in a dense than in a thin forest, and greater in a young plantation where the trees are numerous than in an old one where they are further apart. The regular rows also facilitate the thinning out always required when the trees are young, which may be done with more ease and uniformity than where they are irregularly scattered.

PLANTING THE SEED.

The seeds of different kinds of trees require very different treatment. The elm, for example, matures its seed early in the season, and it may be planted at once and grow the same season. The maple, pine, oak, chestnut, and nearly all forest trees, do not mature their seed till autumn, and they must be planted either then or early in spring, according to circumstances. Those which have a horny covering, like the chestnut and horse-chestnut, must never be allowed to become dry, because the covering is then impervious to moisture, and they will not germinate. As soon, therefore, as the ripe seed drops from the tree it should be either planted immediately, or else mixed with some material that will retain moisture, such as moist sand or peat or damp moss, and kept in this state until planted in spring; or the seeds may be left on the surface of the ground, secure from the attacks of mice, and covered with moss or forest leaves. This exposure to the weather will cause them to sprout early, and they should therefore be planted as soon as the frost leaves the ground. The failure of germination in nuts and other seeds is commonly owing to their becoming dry before planting. Frequent alternate soaking in water and exposure to frost will often restore them; and they will sometimes grow the second year after planting if the drying process has not extended too far, but the only certain way for success is to preserve a uniform degree of moisture from the moment of the dropping of the seed until vegetation commences.

Leguminous seeds, the locust for example, do not require the precaution just mentioned, as they become thoroughly dry on the tree. The seeds of the yel-

low locust, however, (*Robinia pseudo-acacia,*) will never grow if merely planted in the usual way, in their hard and horny state. The best mode among planters is to swell them by scalding in the following manner: Pour boiling water into a tin pan containing about a pint or a quart of the seed, and allow it to stand several hours in a warm room. A part of the seed will then be found to have swollen much in size, and to have assumed a lighter color. They may be separated by the hand, or by means of a sieve that will just allow the unswollen seeds to pass through; and if now planted will come up freely. The remainder may be again repeatedly subjected to the same process until all have been prepared.

Seeds of the pines and spruces are mostly quite small, and the young plants being minute and delicate are liable in this country to be destroyed by the hot sun. The best way, therefore, is to plant them in beds of finely pulverized mould, and keep the surface shaded by screens of white cloth or of straw matting. The cloth succeeds the best, as it allows the free admission of light, but not of the hot rays. After two years' growth these seedlings are transplanted into nursery rows, or where they can have more room. It sometimes happens that the seeds of evergreens, as well as of other trees, when sown spontaneously in the shade of thin woods, will come up and grow thickly without any care being given to them; but this mode cannot be relied on, and may be adopted only to advantage where it is found actually to occur by excluding all cattle and other intruders which would destroy the young plantation, and subsequently, in a few years, cutting away all the larger growth, so as to give the young trees an even chance.

DEPTH FOR PLANTING SEED.

The depth should be nearly in accordance with the size of the seed. The smallest evergreens, for instance, should not be buried more than the fourth of an inch. It is usually performed by sifting fine mould over them to this depth. The larger pine seeds may be placed half an inch to an inch deep. Maples should not be covered deeper than this, while two inches will not be too deep for the chestnut, and even three inches for the larger nuts. This depth, however, must be somewhat modified by the character of the soil. If heavy and compact, they will bear a less depth than in a sandy, porous, or gravelly earth. Seeds planted very early in spring should have a shallower covering than later in the season, when a greater depth may be needed to secure proper moisture. Deep planting is always disadvantageous, as numerous experiments have fully shown, but must be resorted to in dry soils, to prevent the greater evil of not growing at all.

Planting seeds late in autumn is better than spring planting, because no injury can be done to them by removal or handling after sprouting has commenced, and the trees usually receive an earlier start. The only disadvantages are a liability to be destroyed by mice in winter—an evil the probability of which must be judged by every planter—and the formation of a hard crust by the long settling of the soil, through which the young plants cannot readily penetrate. This difficulty is greater on heavy than on light soils, and may be prevented by sprinkling or sifting over the surface before winter sets in a coating of fine manure, pulverized compost, or leaf-mould, or peat.

THINNING OUT PLANTATIONS.

The principle extends through all kinds of vegetable growth that the distance asunder must accord somewhat with the size of the plant. Every farmer is familiar with the fact that his crops may be injured by planting too thickly as well as thinly over the surface. It is an important point to know the true

medium. It is the same with timber plantations, where the number of trees must be reduced as the growth advances in size. At first the planting should be quite thick, because a considerable amount of profit may be derived from the hoop-poles, small timber, &c., from the first cutting, and also from the straighter and better growth of the trees which are left. It has been found by experience, more particularly in the young wood plantations of New England, that a field of young timber which has been properly thinned is more than doubled in value when compared with a plantation which has been neglected This fact will be obvious to any one who remembers that all natural plantations consist of a mass of straight and crooked trees and thrifty and unthrifty ones, and that none can grow to much advantage so long as the whole remains a promiscuous mass, like a brush-heap. Carpenters and lumbermen are familiar with the fact that perfectly straight sticks of timber are worth many times more than crooked and cross-grained ones, and that "clear stuff" usually sells from double to triple the price brought by imperfect and knotty plank and boards. In addition to all this, experience has proved that the actual amount is greatly increased by judicious thinning, which gives every tree its due amount of space for growing to the best advantage.

The distance apart among the trees cannot be accurately given as a fixed rule, and authorities considerably differ on this subject. Some have stated the distance as great as one-half the height of the trees. This could only be applicable to young and thrifty plantations, where the distance would soon be only a third or a fourth the height. Some trees, as pines and larches, which assume a tall form and narrow head, will grow to advantage more closely than oaks, elms, and maples, which have a more spreading habit. Trees intended for timber, if too much thinned, will throw out side branches and form knotty trunks, while this would be no objection to wood for fuel. In all cases, the trees, both young and old, should be so near together that the falling leaves will shade the whole ground, and that the winds may not sweep them off, nor grass grow among them. English authorities state that artificial plantations, which are made extensively in Britain, by setting out the young trees, are commenced at about four or five feet apart. As these plantations are chiefly intended for timber trees, and the most valuable (the oak, for instance) being frequently feeble and slow-growing when young, they are sheltered from severe winds by an intermixture of other sorts of more vigorous growth termed "nurses." These nurses are more numerously planted on the more exposed situations. They are selected on account of their value for cutting when young, and are gradually thinned out as the timber trees advance. Fifteen feet apart is given as a proper distance for Scotch pines at forty years of age, and this distance would probably apply to other timber trees. The greatest distance for large full-grown trees is mentioned at twenty-five or thirty feet. These distances, being intended for the growth of trees for timber, which is harder, tougher, and more durable when not grown too much crowded, may be less where the sole object is the growth of wood for fuel.

ADAPTATION OF SPECIES TO SOILS.

In Europe, where much attention has been given to planting woodlands, the fitness of particular kinds to various soils has been thoroughly studied. In this country much experience will be required to reach all the information we desire on the subject. It is true much may be learned from an examination of natural localities. But it is not always correct to suppose that trees will grow best where they are most usually found, for experiment has shown that some species which are nearly always inhabitants of wet places, or even swamps, grow more rapidly when transplanted to uplands. Others, generally found in sterile soils, appear to be confined to such places in consequence of having been crowded out

of better localities by stronger growers. There are, however, a few well-established rules. The chestnut, for example, will grow better on a light soil than on one which is low and heavy, where the elm might flourish well. But it will be found in nearly all cases that a good soil, under good cultivation, while the trees are small, will favor a vigorous growth in nearly every species; and an undrained or wet soil will be adverse to success with most of the kinds worth raising, and can only be adopted for such trees as the elm, willow, &c.

MIXTURE OF DIFFERENT SPECIES.

On this subject, also, we require more information and further experiments. It is the opinion of some planters that a heavier growth may be obtained from a given extent of land by intermingling different kinds, each of which may draw different ingredients from the soil, or extend their roots into earth at different depths. "The ash," says C. W. Johnson, "and more particularly the locust, are very obnoxious to most trees. Then, again, the grouping together of certain trees is particularly grateful to them all. Thus the larch is a very good neighbor; the Scotch fir, the birch, and the Spanish chestnut grow very luxuriantly with it; the oak, the elm, the hazel, and horn-beam are very good neighbors." This subject is merely mentioned for the purpose of inviting further observation and trial.

THE RESULTS OF EXPERIMENTS.

Nine years ago Levi Bartlett, of New Hampshire, furnished me some valuable practical information in relation to the growth and thinning of young forests. He says:

"About twenty-five years ago I came into possession of several acres of 'pine plain land,' covered with a thick growth of white, yellow, and Norway pines; the trees were then about twenty-five years from the seed. (The land was burned over in a very dry time, about the year 1800.) Immediately after I came into possession I thinned out the growth on about two acres, removing more than half the number of trees, they being the smaller portion; the wood thinned out much more than paying the expense of thinning and drawing. Soon after I sold the land, since which nothing has been done to it. I have, with the present owner, recently examined the lot; we were of the opinion that the portion thinned some twenty-five years ago is now, from the superior size of the trees, worth thirty-three per cent. more per acre than that portion left to itself. Can any one doubt that the limbs and tops of the removed trees, and the decaying stumps and roots of those cut out, with a free access of sunlight and air, has not very much increased the growth where thinned out, over those left to struggle, from the excess of numbers, for the mastery? Many of the vanquished have died, while the victors have suffered severely from the effects of the struggle. I sold the land for ten dollars per acre; the present owner has recently refused one hundred dollars per acre for it. Had he judiciously thinned out from the time he purchased it till now he might have (without injury to its present worth) taken from it enough to have paid the interest on his purchase and taxes. I have thinned out the growth of hard-wood trees with results similar to the above described."

He further adds that, at the time of the first thinning, he cut a few of the longest about that time for rafters for a shed, only hewing one side; they were about eight inches in diameter at the stump. Probably they were about forty or fifty feet high—that is, the tallest of them being twenty-five years from seed. When he visited the lot he and the owner were of the opinion that, if the trees were equidistant over the two acres thinned out, they would stand at the distance of from six to eight feet. These were mostly Norway pines, straight and beautiful as cane-poles, from eighty to over one hundred feet high, and from ten to eighteen or twenty inches diameter at the stump, then about fifty years from seed. He again visited the lot seven years afterwards, and was surprised at the increased growth of the trees, especially on the portion thinned thirty years before. "The owner had done nothing to it except occasionally cutting out a few dead trees for top-poling walls. It was the opinion of both of us that

the portion thinned out is now worth twice as much per acre as the part not thinned—not, however, that there is twice the amount of wood on the thinned portion, but from the extra size and length of the trees, and their enhanced value for board, logs, and timber. There are hundreds of Norway and white pine trees that could be hewn or sawed into square timber from forty to fifty feet in length, suitable for the frames of large houses, barns, and other buildings. There are some dead standing trees among those which were thinned, but they are wholly the smallest sized ones that have been overgrown and shaded by the larger trees. On the part of the lot left to nature's thinning out, there are a vastly greater number of dead trees; many of them have fallen, and are now lying on the ground, and are nearly worthless. Of the dead trees standing, cords might be cut; they are well dried, and would make capital fuel. I scolded the owner for suffering such a waste of fire-wood. The trees are now about fifty-five years from the seed."

According to the preceding statement, there were pine trees of fifty years growth eighty to one hundred feet high, ten to twenty inches in diameter, and standing six to eight feet apart, the trees having been thinned out, and having received the best treatment. If there is no mistake in this statement, there would be about *three hundred cords per acre;* for every two trees on an average would make a cord of wood, supposing them to average thirteen inches in diameter, sixty-four feet high, and eight feet apart. This estimate may be from too high data; but if only half that amount, it would show much in favor of proper management. On the timbered lands of western New York forty to fifty cords per acre is usually regarded as a fair average, sixty to seventy cords very heavy, and eighty to a hundred an extraordinary product. In these instances the growth of the timber has had to take its natural course, with all the disadvantages of being too thin in some places, too thick and crowded in others, and with old and young trees promiscuously mixed together. It is not at all unlikely that with the advantages of the best management a larger amount might be obtained, and that the estimate just made may not exceed probability.

I am unable to find similar statements of the actual product of young or artificial forests, but an examination of the growth of existing trees will serve to show approximately what may be accomplished in a limited term of years. On the grounds of Samuel Rhoads, of West Philadelphia, I measured two years ago the trunks of several Norway spruce trees twenty-three years after they were set out; they average two feet in diameter, three feet from the ground, and were about fifty feet high; they had plenty of room for the extension of side branches, which formed a circle of about thirty-five feet in diameter. Had they been planted more closely together the trunks would doubtless have been of less diameter and the trees taller. A red cedar, planted in 1802, is now forty feet high, and eighteen inches in diameter.

R. S. Fay, of Massachusetts, gives a statement in the Country Gentleman, in 1862, of many measurements which he had made on his own plantation. These plantations were commenced in 1847 and '48, the trees being mostly about three feet high, and the only attention they have since received being a judicious thinning out, and the measurements being at fourteen and fifteen years from commencement, and four feet from the ground: white maples, thirteen to fifteen inches in diameter; Norway maples, eight to eleven inches; rock maples, seven to nine inches; pin oak, ten inches; overcup white oak, seven inches; white oak, six inches; American elm, from seed, ten inches; Spanish chestnut, eleven inches; canoe birch, nine inches; Scotch larch, eight to ten inches; Norway spruce, eight to ten inches; Austrian pine, eight to nine inches; Scotch fir, eight to nine inches; white pine, nine to ten inches. There was no cultivation of the soil where these trees stood. I lately measured the trunks of a row of sugar maples set out eighteen years ago in the town of Sennett, Cayuga county, New York, by H. Fellows. They stood by the roadside, re-

ceived no care, and now average one foot in diameter, and thirty feet high. Had these trees stood in close plantations their diameter would have been less, but their height greater. I have measured trees of the Scotch larch on my own grounds, about two feet high when transplanted, and which have grown eight years since, standing five feet apart, which are seven inches in diameter, and over twenty feet high. These would afford at the rate of eighteen cords per acre.

From the preceding examples, which are taken at random, it will be seen that, by selecting good growers, we may have young forests with trees five or six inches in diameter at ten years, nine to fifteen inches in diameter at twenty years, and one to two feet in diameter in thirty to fifty years.

QUANTITY OF TIMBER OBTAINED, AND AGE FOR CUTTING.

Various estimates will be made as to the quantity of timber or wood afforded, and the most profitable age for cutting. The Salisbury Iron Company, which existed many years, and owned several thousand acres for the express purpose of furnishing wood, found by experiment that the most profitable period was to cut once in sixteen years. Beyond this time the annual increase was not so great as before. It had been found that this yielded a full equivalent to an annual interest on $16 to $20 an acre, which, for a rough and poor soil, remote from a wood or timber market, pays as much as the net profits on cultivated land in the same neighborhood. L. Bartlett has furnished, at my request, the following information on this subject. He says:

"By referring to different authorities, I find a great difference of opinion. In France eighteen years is the period the law allows the owners to cut over their wood lots. (There fuel is sold by the pound and ounce.) The late Mr. Colman cites, in one of his reports, the opinions of many farmers in Massachusetts, who give the time from twenty to thirty years to cut off the entire growth for fuel and charcoal. However, circumstances in different localities must prevent any fixed rule in this matter. Mr. C., in his Report of Massachusetts Agriculture, gives statements of several farmers in reference to the growth of wood. F. Loring cuts once in fifteen or twenty years oak wood; gets thirty cords per acre. Another states that a thin or exhausted soil will give twenty-five cords in twenty-five years, and that good land in thirty years will give fifty cords to an acre. E. Parker, of Reading, sold forty acres of woodland, on which the wood was of only twenty years' growth. The whole lot averaged more than forty cords to the acre."

According to the statement just quoted twenty years' growth gave forty cords per acre. We are not informed that this was managed in the best and most profitable manner, nor of the fertility of the soil; yet, at this rate, a ten-acre lot would furnish an annual supply to a family of twenty cords per annum. By counting the annual rings, it has been found that all the larger forest trees of western New York are much over a hundred years old; but if we estimate their average period of growth at one hundred years, and an acre as affording sixty cords of wood, it would require thirty-three acres to keep up a perpetual supply for a family consuming twenty cords per annum, or more than three times the extent of land in the case cited by H. Colman, where the growth was cut at twenty years.

Governor Holbrook, of Vermont, furnished some years ago to the Albany *Cultivator* the following statement of his own observations in relation to the successful growth of young timber:

"Ten years ago I cut the wood off a long stretch of side-hill, and, in my inexperience, burnt over a portion of it for pasturage. The remainder was left to grow up again to wood. Many of the young trees are six to eight inches through; they are all very straight and thrifty, and I value one acre of this land more than five acres which are in pasture. I shall not again permanently clear up my steep hill-sides.

"At the solicitation of a railroad friend, a short time since, I accompanied him into the country directly south of this to examine and estimate the value of some wood-lots. I was forcibly struck with the amount of rugged, barren land, inaccessible for agricultural purposes, which had been thrown into open country, even by the present owners. Had a second growth of wood been permitted to run up on the land, instead of subjecting it to the burning

and cropping process, it would have been now worth far more to the owners, for a railroad is tapping that country with its large and clamorous demands for wood and timber. Riding along with an old inhabitant of one of the towns visited, he pointed out a wood-lot which was cut over twenty years since and suffered to grow up again to wood, contrary to the usual custom. It was sold at auction a short time since for $3,400. It would not have brought over $800 had it been in pasture from the time it was cleared.

"Warm hill-sides, having an eastern or southern slope, send up a second growth of wood with great rapidity. Although they may not eventually support so heavy a growth as strong level land, they will yet produce all the wood they are capable of sustaining much sooner. A friend directed my attention the other day to a tract of land with an eastern slope in a neighboring town which was cleared of an original growth of wood twenty-five years ago, and left to itself to produce another growth from the sprout. The land, with its present standing wood, was appraised a year or two since at $50 an acre. Ten dollars an acre is all that similar land in pasture in that vicinity has ever been worth. By the application of a little arithmetic, then, we find that the increase of this second growth of wood has been equal to 16 per cent. interest per annum on the worth of the land, without a dollar's expense for the cultivation; that is, $10 at 16 per cent., simple interest, for 25 years, amounts to $40; to which add the principal, the worth of the land, and we have $50, the appraised present value per acre.

"Several successful attempts have been made within my observation in improving rugged and exhausted lands by planting them out to trees. Within sight, while writing, is a knoll that has been completely renovated by a plantation of the white locust. It was originally a coarse, worthless gravel, barren of herbage of any kind. I remember that the proprietor was laughed at by his neighbors for attempting to grow trees on his barren gravel. The locust got root, however, and, although their growth was slow and feeble, they gradually formed a soil by the annual shedding of their leaves; and as the soil became thus strengthened their growth became more vigorous, new shoots sprang up in all directions from the roots, and after awhile clover and other grasses began to appear on the open ground. I have been curious to observe the gradual improvement of this land. Last summer I noticed that the grass was very luxuriant, and would have yielded at the rate of a ton or more of hay to the acre in the open spots. The locust wonderfully endows a poor soil with new energy and fertility. It seems to make its demands for nourishment more largely upon the atmosphere than any other tree, and gains foothold in soils absolutely barren of fertility. Then, again, its leaves are small, with very rough edges, lying perfectly still where they fall, while those of most other trees are blown about by the wind, collecting in hollows or in large heaps."

Governor Holbrook adds the statement of the late John Lowell of an experiment in the management of wood plantations. The land was planted and kept cultivated with potatoes for two years; pines were taken up out of the forest with great care, not more than five feet high; larger trees were lost or became sickly; acorns were planted in some plaees; and other hard-wood trees, transplanted from the forest, were of more feeble growth, and were sawed off at the ground, and vigorous shoots sprung up in their place. In fourteen years he had a young, beautiful, and thrifty plantation of trees, twenty-five to thirty-five feet high, and the largest, which were pine, nine to twelve inches in diameter. The loppings and thinnings of these trees furnished abundant fuel for summer use; and from an accurate calculation, he was convinced that the growth at that time would amply pay for the land at the price it would have brought.

SORGHUM, OR NORTHERN SUGAR-CANE.

BY WM. CLOUGH, CINCINNATI, (OHIO,) EDITOR OF SORGO JOURNAL.

VARIETIES.

THE different varieties of sugar-cane cultivated in the north are all properly included under the generic term *Sorghum*. The cane from the Chinese seed is called *Sorgo*, and that from the African, of which there are many varieties, *Imphee*. The different varieties or sub-varieties of the imphee are distinguished from each other by the native titles communicated by Mr. Leonard Wray, who imported the original seed and furnished the only account we have of the origin and native characteristics of each.

A variety claimed to be distinct from the Chinese or any of the African stock has been made very prominent within the last few years under the name of *Otaheitan* cane. This variety corresponds very nearly or exactly with what is known as the *Oom-see-a-na*, one of the imphees, and as it is not distinctly traceable to any other source, it is believed to be identical with it. It certainly bears no resemblance to the Otaheitan cane of the tropics, nor could it have been derived from the island of Otaheite.

Still another variety has recently appeared, to which the term *Liberian* has been applied. The seed of this cane appears to have come from Liberia, and the plant does not correspond with any of the varieties described in Mr. Wray's catalogue: it is, however, by no means certain that it is not descended from the imphees. The original seed, brought by Mr. Wray from Kaffir-Land, was first cultivated in France and Belgium, and from thence it was perhaps sent to the Liberian colony, and from there brought to America. It has many qualities in common with the imphees, and may very properly be classed with them. From the Chinese or sorgo cane a new and distinct variety has been developed by cultivation and selection, which is some three or four weeks earlier than the original. This has, however, been acquired at the sacrifice of size of stalk, and, of course, productive capacity.

In Mr. Wray's account of the imphees discovered and imported by him we have a loose, general description of nine different varieties, and the names merely of six more varieties given. As his account has been frequently published in full, and as it is so vague as to be altogether unsatisfactory, we will here include only a brief synopsis, giving, however, everything of a distinctive description which he furnishes.

Vim-bis-chee-a-pa.—This is the largest and tallest of the whole; full of juice, very sweet; requiring from four to five months to come to maturity; grows to a height of ten to fifteen feet; from one and a half to two inches in diameter at the lower end; usually cracks or splits as it ripens; juice contains fourteen per cent. of sugar; seed-head large and beautiful, twelve to eighteen inches in length; plump seeds, sandy color, strongly held by a sheath, which partially envelops them.

E-a-na-moo-dee.—Next in size and very similar in habit and value; not so coarse, softer, and more juicy; fourteen per cent. of sugar; seed-heads large, stiff, erect; seeds round, plump, of a clear yellow color; ripens two weeks earlier than last variety.

E-en-gha.—A fine tall kind, from ten to twelve feet high, more slender than either of the foregoing, exceedingly graceful in appearance; ripens in four months; fourteen per cent. of sugar in juice; seed-head large and very pretty; seed upon long slender footstalks, which are bent down by weight of seed, forming a graceful drooping; seeds a dull yellow color, rather long and flat.

Ne-a-za-na.—Held by the Zulu Kaffirs to be the sweetest of all the imphees; ripens in about three months; stalks soft and more abounding in juice than any; fifteen per cent. of sugar; small size, tillers greatly, having sometimes fifteen stalks to one root; juice mucilaginous, and abounding more in fecula than some other varieties; seed-heads very bushy and bunchy when ripe; seeds round, large, and plump.

Boom-veva-na.—Most excellent and valuable variety; juice never contains less than fifteen per cent. of sugar; resembles the *E-en-gha*, but stalks brighter and more slender; stalks have a pinkish tint, and seed-cases have a pink and purple hue mixed with a yellow ground; short, stiff footstalks; tillers very much, giving ten to twenty stalks for one root, but seldom weigh more than one pound each; makes beautiful sugar; reaches perfection in three to three and a half months.*

Oom-see-a-na.—Distinguished by the purple or black appearance of its seed-heads, the *sheath* or *seed-cases* being of this color and not the seed itself; seed-head stiff, erect; short, strong footstalks; seed large, round, and full; growth and goodness of juice very similar to the *Boom-veva-na;* stalks small, numerous.†

Shla-goo-va.—Slightly inferior to the three last mentioned; ripens in three and a half months; tall, good-sized plant; chief distinction, exceeding beauty and elegance of seed-head; footstalks extremely long, drooping gracefully; seed-cases or sheaths vary in color from a delicate pink to red, and from a light to a very dark purple, but each color is very bright and glistening.

Shla-goon-dee.—Sweet and good; under favorable conditions produces fine sized stalks; seed-heads very stiff, erect; seed vessels compact and very close; usually requires three and a half months to reach maturity.

Zim-moo-ma-na.—Likewise a sweet and good variety; seed-heads upright, compact, and fine; seeds plump, very numerous.

E-both-la, Boo-ee-a-na, Koom-ba-na, See-en-gla, Zim-ba-za-na, and *E-thlo-sa* are merely mentioned by Mr. Wray with the remark that they "form the remainder of fifteen varieties, each differing slightly from the others in saccharine quantities, as well as in appearance, but still easily distinguished from each other by any one who has studied them."

The foregoing includes all that has been communicated from any source with reference to the original characteristics of the different members of the imphee family. The descriptions are, with one or two exceptions, too vague to be applied with any certainty to the descendants of the original stock, even if they all existed in the country, and had undergone no change. But the varieties still extant have been gradually modified by the climate, soil, and cultivation until the original marks have been in many greatly modified, and in others wholly lost. But five or six distinct varieties of imphee can now be traced. To these the barbarous names imported with the seed are somewhat fancifully and indiscriminately applied by operators, there being little uniformity in the use of names, except with reference to the *Boom-see-a-na* and *Nee-a-za-na.* The im-

* This description is regarded by some as applying to the cane already mentioned under the name of Liberian. It fails, however, to refer definitely to the seed, which is very characteristic, small, quite round, and red, so peculiar as hardly to escape mention. The so-called Liberian is not tall, but stalks large; is *not* early, requiring four and a half months to mature.

† We find the stalks tall and good size; a four months' cane in this country.

portance of having specific names for each variety, accompanied with a minute, popular, and botanical description of each, is now much felt. The subject has received the attention of the State conventions of cane-growers the past season, and a suitable committee has been appointed to classify, describe, and apply distinctive names to all known varieties.

HYBRIDIZATION.

This is the popular, though incorrect, term for the mixing of the different varieties of cane with each other, and with the baser grasses, such as doura-cane, broom-corn, &c. The notion prevails almost universally that this mixing of varieties, producing a mongrel cane, is liable to occur. In answer to circulars, addressed by the writer to about two thousand cane-growers, asking the opinion of each upon this point, the responses were eighty-three per cent. in the affirmative and sixteen per cent. in the negative.

That the cane, under some circumstances, deteriorates and becomes utterly worthless, there can be no doubt. This sometimes occurs with an occasional stalk here and there in the field; sometimes an entire field will be found affected; in other cases a gradual deterioration for several years will be manifested. In some instances it is attended with an extraordinary overgrowth of stalk, frequently with a long broom-like panicle; in others the pith becomes more or less dry and devoid of saccharine matter, frequently acquiring a red hue, called the "blight."

These occurrences, or most of them, have been found to proceed, in some cases at least, from other than the cause to which they are popularly referred—the mixing of varieties; and it is at least possible that the popular notion upon this subject is erroneous.

Variations from the normal course in plants and animals, without the intermixing of varieties, are of no uncommon occurrence. These variations are sometimes marked and distinct, establishing themselves ultimately into new and permanent types. A plant brought from the remote part of the world, and subjected to new conditions of soil, climate, and cultivation, might be expected to manifest occasional and very marked variations from the original character. It is, perhaps, remarkable that our canes have not, under the circumstances, shown more frequent instances of departure from their native course and character of development. We do not oppose the popular theory on this subject, and would advise the operator by no means to plant cane-seed that has been grown in proximity to broom-corn. Yet it is proper to refrain from any definite conclusion upon the question of mongrel varieties of cane until the effect of other causes, known to produce the same phenomena, are more carefully studied.

PROGRESS OF THE CANE ENTERPRISE.

The Chinese variety was first introduced into Europe by Count de Montigny, consul of France at Shanghai, in 1851. From the package of seed sent by this nobleman to the Geographical Society of Paris, but *one* seed germinated. From this a small quantity of seed was matured, and the next year carefully cultivated. From this seed Messrs. Vilmorin, Andrieux, & Co., seed merchants of Paris, procured eight hundred seeds, for which they paid eight hundred francs. The product of this seed, and of another portion of the same crop, cultivated by Count de Beauregard, furnished the Chinese or Sorgo seed, which was distributed far and wide over Europe, and afterwards over this country.

Two years after the introduction of the Chinese seed, in April, 1857, Mr. Wray arrived in America with his African seed, and confided it to Governor Hammond, of South Carolina, Colonel S. Peters, of Georgia, and Mr. D. Redmond, editor of the Southern Cultivator. Through many vicissitudes, which came

near rendering the whole enterprise abortive, a small quantity of pure seed was secured, and this is the source of the African or Imphee varieties of cane now cultivated in America.

The promise, though at first vague, of securing a sugar-bearing plant adapted to our remote, ultra-tropical latitude, was enough to attract the earnest attention of the northern farmer as soon as suggested, and the business of raising and working the cane was immediately commenced in many of the great western and middle States. The enterprise was, however, beset with many difficulties. It was an entirely new business. Not only were all the ordinary obstacles attending the naturalization of a new plant to be encountered, including the intricate questions of soil and cultivation, but it involved in the ultimate process of manufacturing the practice of an art with which the producer was wholly unacquainted.

The last obstacle became still more formidable when it shortly transpired that the processes employed in the south were not applicable to the juice of the newly adopted plant. This and the numerous reverses and disappointments of various kinds to which the pioneer workers were subjected would have caused the utter abandonment of the enterprise by any class of men less versatile and less persistent than that peculiar race, the northern farmer-mechanic. With him a cherished object is not willingly surrendered, and never until all the appliances of art and ingenuity, in both of which he abounds, are exhausted.

The work has now been prosecuted for nine years with a constant and regular increase in public interest and in practical results. The number of producers has multiplied largely from year to year, while in the quality of the product the improvement has been such as to confirm the most sanguine expectations ever entertained with reference to it. It has demonstrated the capacity of that immense and populous belt forming our middle zone to produce its own sweets, thereby adding a new product which, at a trifling cost, saves the expenditure of millions in the purchase of a foreign commodity. Unaided by science, without experience, and under many discouragements, the northern planter has steadily prosecuted the work. In the absence of any intelligence from others to direct his labors, he has resorted to bold conjecture and wild expedient, until, by numerous experiments and failures, he has suceeeded in establishing a tolerably complete system, without having, even now, any very definite notion of the philosophy upon which it is founded.

The *sorghum* interest has now an importance which enables it to command the scientific aids which have hitherto been withheld. The production of sugar from any of its natural sources is necessarily an intricate and difficult art. Its production from the tropical cane and from the sugar-beet has engaged the attention and constant service of the ablest chemists in the world. Without their aid the business would have been comparatively unsuccessful. But until the work was undertaken by the Department of Agriculture our northern cane received few favors from science. On the other hand, the enterprise has been treated in scientific circles with a species of indifference amounting practically to a stigma. This, however, the sturdy operators have been able to survive, and now they are permitted to enjoy the success of their undertaking; perhaps not the first triumph of unskilled art over the adverse auguries of the learned.

PLANTING AND CULTIVATING.

In the work of preparing the ground, seeding, and cultivating, the implements in common use on the farm are all that are needed. No crop affords a more generous return for labor and attention in the field than cane. It is a remarkably deep-rooted plant; hence deep ploughing is of the utmost importance. The ground should be prepared the same as for corn, with as much

additional care as the operator can conveniently bestow. Lime, plaster, ashes, and well-rotted manure may be used freely. The preponderance of testimony is, however, adverse to the use of fresh stable manure. The opinion which formerly prevailed that land should not be rich is exploded. No matter how rich, if not burdened with rank, undigested manures.

In planting let no time be lost in the spring *after* the earth is in a suitable condition to receive the seed; cover very slightly; half an inch is usually deep enough, if the soil is damp and in good condition. Soaking and sprouting the seed previously to planting will secure a gain of several days in the early growth, which is very important, as the tardiness of the cane in its early stages gives the weeds the advantage. Many report that they fail to realize any advantage from soaking the seed; perhaps the failure is from injudicious management. When the seed has been soaked, and perhaps sprouted, the condition of the soil and depth of covering should be carefully considered with reference thereto. It is hardly necessary to remark that seed which has been germinated, if planted in dry earth and covered very shallow, will of course perish. The distance between rows may be four feet, and between hills three and a half feet. In the west it is considered much the best to plant in "check rows," permitting the crop to be worked both ways with the cultivator, if drilled, four feet between rows, and either continuously, to be afterward thinned out, or at intervals of twelve or eighteen inches. The quantity of cane which can be grown to advantage on any given breadth of ground, whether in hills or drills, depends wholly upon the nature of the soil. As this is a matter of considerable importance, it should receive careful attention. On high strong ground ten or twelve stalks may be grown in a hill, or in a space which, if the soil were weak, would not support more than two or three, and these insufficiently. If an excess of plants is allowed, the growth will be feeble and sluggish; if, on the other hand, the quantity is insufficient, the energies of the soil will develop, with some varieties of cane, innumerable *suckers*, which rob and dwarf the main plant, and do not themselves mature, or only in part. As it is desirable to occupy the ground fully with an original, uniform growth, it is best to plant an excess rather than an insufficient quantity of seed, and afterwards thin out if too many plants appear. Young cane is very tenacious, and may be transplanted with more safety than almost any other plant. The labor of transplanting is, of course, considerable, and will be generally avoided; but in latitudes where cane cannot be matured from the seed direct, this plan may be resorted to.

In cultivating, all the labor bestowed in the early stages will be well rewarded. Its sluggish growth for a few weeks after the young blades appear is discouraging to persons unacquainted with its habits, and frequently causes it to be neglected, and in some instances abandoned, at a time when it merely needs the attentions of the cultivator and hoe. Its hardiness secures it from injury by what may be called rough cultivation. It submits to the utmost freedom with the implement, and pines only when neglected. Late cultivation prolongs the growth and retards maturity; hence, in latitudes where the season is short, this should be avoided. It is not proper to plough deep furrows after the cane has acquired considerable size; the roots permeate the whole ground from one row to another, and deep ploughing will sever them to such an extent as to dwarf the cane.

MATURITY.

Experiments have been made to determine the most appropriate time for harvesting the cane, also with reference to stripping, cutting, topping, and shocking, each of which will be briefly considered.

The saccharine property begins to manifest itself in most of the varieties of

cane just before the seed-heads appear, and increases in richness at least in the lower part of the stalk until the seed-head is fully formed, the sugar required for the flower and to form the starch of the seed being in the mean time absorbed from the upper part of the stalk mainly from above the upper joint. After the seed is filled out and the cane fully mature, the fluids of the stalk begin to disappear, and the stores of sugar either pass down to the root or are converted to woody fibre unless the organization of the plant has been disturbed by frosts, in which case the sugar ferments and passes into the acetic state. It seems most probable that, after the maturity of the cane, its excess of wealth returns to the root, there to supply sustenance for another growth of plants, and, if not arrested by winter, the natural course of the plant would be to reproduce itself continually from the root like the common field grasses. The experiment of covering the roots and protecting them from winter would be interesting, and might afford some valuable suggestions. The precise period most appropriate for harvesting the cane is when the saccharine properties are fully developed and before any supplementary action sets in, having reference also to the purity of the juice and to its security from fermentation in case the cane is not immediately ground. This will be found to be at the time when the seed at the middle of the panicle is just beginning to harden, or to pass from the fluid or milky state.

STRIPPING.

This is a laborious operation. When the business is extensive it is more common to grind the cane without removing the leaves. If they have been killed by frost, or if, after being cut, the cane is left on the ground until the blades are cured, they do no harm to the product. They are, however, an incumbrance in handling the cane, and increase the bulk of material to pass through the mill; they also carry off a small amount of juice adhering to their surfaces. In small operations, and when it can be done conveniently, the cane should be stripped. Strippers have been invented, but they generally require a separate operation to each stalk, and it is hardly necessary to say they afford no assistance. If stripped before the cane is cut, the work is most expeditiously done by hand, protected, if necessary, by a pair of leather mittens. But this is very laborious. A quick downward stroke with a wooden sword or a forked rod will remove all the blades encountered in the stroke, and, with a little practice, two or three blows will remove nearly all the blades in a hill. The following will be found, in many cases, a convenient mode of removing the blades. The cane having been cut, and immediately, while the leaves are fresh, hauled to the mill or place of deposit, is there thrown into heaps for greater convenience on a pair of trestles, the tops all one way. The stalks are then seized by the smaller ends, two or three at a time, and quickly jerked out from the heap, leaving the blades behind. The blades may, by this means, be saved for fodder with less labor and trouble than in any other way. Stripping the cane some days or weeks before it is cut, as recommended by some, is attended with loss. The fluids of the cane are, of course, evaporated to a considerable extent; the operation is a violence to the life of the plant, and in some way, either by decomposition of sugar or by conversion to woody fibre, the saccharine richness of the juice escapes, or fails to increase in proportion to the loss of water.

TOPPING.

The experiment of topping the cane at various stages of development has been tried. When the seed-head is removed before flowering, particularly if the cane is growing vigorously at the time, the stalk is liable to put out shoots at the joints by which it is impoverished more than by being allowed to develop

its original seed-head. If removed after the flower appears, and if the season is somewhat dry, a growth at the joints may not appear, and it is claimed by some that the cane is found more rich and juicy. Of course the crop of seed is sacrificed, and the writer cannot say, after careful observation, that any gain in the quality of the juice is positively realized. Besides, there may be a slight development of buds at the joints produced by this interference with the natural process, and as these buds, perhaps, contain *diastase*, the presence of which in the juice must be injurious, the plan cannot be recommended without caution.

The operation of topping is most conveniently performed when the cane is cut by a stroke or two with the cane knife while the stalks are held in the hand. This leaves the seed scattered on the ground where it may lie until cured. If the cane when cut is laid evenly in heaps on the ground the tops may be cut off where it lies, leaving them less scattered and more conveniently gathered. Still another plan is to leave the tops until the cane is hauled, the stalks being laid evenly on the wagon with the tops overhanging at the sides and after end; the wagon is stopped at a point selected, and the driver passes around with a sharp cane knife, and, in a minute or two, is able to remove all the heads which project in sight. But few will escape. This brings the seed all to one point, and saves the labor of collecting it from the field.

CUTTING.

But little need be said on this point. The operation when performed by hand is similar to the work of cutting corn. Unless the leaves are nearly dry the cane should be thrown upon the ground, and not put into shocks until partly cured. If the blades have been killed by frost, or if the cane has been stripped, it should be put immediately into shocks.

An implement invented for harvesting corn has been partially adapted to cutting cane. It has a short cutting apparatus similar to a reaper, and is furnished with a reel and a platform upon which the cane falls as it is cut, and this is discharged by the driver at short intervals. When made sufficiently strong, and so modified or improved as to be secure from clogging with weeds, it will be a useful implement for large operators. Its performance with one man and two horses is about equal to the work of five men cutting by hand.

SHOCKING AND HOUSING.

Cane, if nearly mature, and if not touched by the frost before being cut, may be kept a long time without injury. A portion of water disappears by evaporation, and probably a small amount of sugar is lost, but at the same time the green film upon the surface of the cane, and the feculent properties of the plant become modified, and are less prominent in juice. If the blades have not been removed, they should be at least partially dry before the cane is housed or stacked. The cane may then be shocked in the field, protected by weeds or straw from the sun and rain, or it may be hauled and stowed in sheds, or it may be thrown into large stacks and covered with blades, straw, or anything else which will afford an adequate protection from the weather. If this operation is attempted early in the season, or when the sun is warm, the cane should not be put into a large body while heated by the sun, or when the dew is on. Later in the season, when the nights are cool, this precaution need not be so carefully observed. Ripe cane may be cut and thrown into small heaps on the ground and allowed to remain a long time, even exposed to repeated freezing and thawing without being greatly injured, particularly if the blades have not been removed, or if blades or weeds are thrown completely over the heaps to prevent the stalks from being warmed by the sun. The juice is, however, rapidly evaporated, and a considerable loss occurs from this cause. Moreover, in seasons of protracted rain the blades become mildewed, and require to be re-

moved before the cane is worked. It is, on the whole, altogether better to stack, shock, or house the cane as soon as it is in a condition to be thus disposed of. Let it not be understood that any of the processes here suggested may be adopted with safety without attention to all the precautions given. The cane should be ripe, or nearly so; the blades, if not removed, and the sheath which surrounds the stalk should be cured, particularly if the cane is bestowed in a large bulk. If early in the season, or in warm weather, handle the cane only in the cool of the day, and when entirely free from dew or dampness. The shocks or stacks must be well protected from rain. Remember that if a stack of cane becomes wet at one point and commences to heat, then the infection will pass rapidly through the whole stack, and all will be damaged or lost.

FROSTS AND FREEZING.

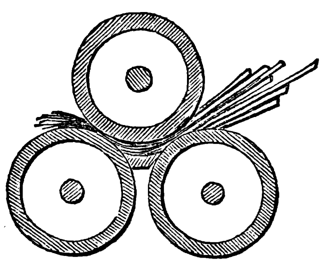
A frost which merely kills the blades and does not freeze the stalk stops or prevents the further development of the cane, but does no other injury. The blades will soon dry by exposing the stalks to the sun, and the juice will rapidly disappear. It is, therefore, best to cut and protect the cane as soon as possible after the blades have been killed. An injurious frost occurs when the thermometer descends two or more degrees below the freezing point. When cutting a stalk of cane, after it has been affected by a freeze, the pith will present a stained or mottled appearance, produced by the rupture of the juice cells and the mingling of their contents with the crude sap of the cane. The latter contains the necessary elements to produce fermentation, and if the temperature is great enough the sugar of the juice is immediately acted upon, and very soon undergoes the vinous, and then the acetic change. The injurious effects of a freeze could be entirely prevented if the cane, after being frozen, could be protected from the sun, or from acquiring a temperature much above 50° or 60°. The vinous fermentation may go on slowly at a lower temperature, but its effects would be almost imperceptible in the cane. It will, therefore, be seen that the injury is not produced by the freeze; this only prepares the way for that which is subsequently produced by heat, and it follows, if the cane can be prevented from acquiring a temperature at which active fermentation occurs, all injury may be avoided. Although this has been explained and enforced many times, and is already tacitly recognized by operators, it seems necessary to repeat it every time the subject of frozen cane is referred to; for, although understood and believed, but few practice upon it when occasion requires. Thousands of acres of cane are annually lost from neglect to harvest and secure the cane from the sun as soon as possible after a freeze. To save time, and to secure all the protection that can be readily afforded, it is best to cut the cane immediately, and then throw it into small heaps between the rows without waiting to remove the tops or blades. Unless very warm weather follows, it will not sustain much injury for a few days until ground. But if it cannot be ground immediately, it should, as soon as the blades are dry, be shocked or stacked. Greater precautions are, however, required to preserve cane that has been frozen than when it has not been thus affected. It is not safe to stow it in large unventilated stacks. It is also found that cane, overtaken by an early, untimely freeze, is more susceptible to injury than when the same occurs later in the season, even though the state of maturity may be the same in both cases. In the latter the nights are cool and the heat of the sun less intense; besides, the cane, as the season advances, seems to become more hardy, acquirng a maturity of stalk and even saccharine richness more than is apparent in cane at the same stage of development, as indicated by the seed-head, earlier in the season. In some of our nothern cane-growing regions the seed rarely matures, the cane being worked quite successfully before the seed-heads fill, while in more southern latitudes the cane at a corresponding stage contains but a slight indication of sweetness.

MACHINERY AND APPARATUS.

In treating of mills, machinery, and evaporators, it is proposed to refer to such prominent and important features in their construction as require attention, and to offer such suggestions as will enable persons about engaging in the business to select apparatus best adapted to the work, avoiding such as are either in plan or construction defective. Purchasers should, as far as possible, know and be able to stipulate for what they require when purchasing a machine, and it then devolves upon the manufacturer to meet those requirements. It is only when the purchaser is ignorant of what he wants, or fails to stipulate for the same, that the seller is able, either wilfully or through his own ignorance, to impose upon him.

CANE MILLS.

Mills for pressing cane and extracting the juice therefrom usually consist of three heavy cast rolls, which, with the connecting gearing, are carried on wrought shafts, and these journalled in brass boxes, carried in strong housings. The latter are firmly bolted to a bed-plate and foundation timbers, and the whole rigidly stayed. Mills with but two rolls are used to a limited extent, but they are less effective; and in tropical countries, those having four, five, and six rolls are sometimes used, though by far the most common construction in all parts of the world at the present time is the mill with three rolls arranged triangularly, as represented in the annexed illustration.



The upper one of the three rolls, against which the other two press, is called the main or master roll; that which with the first receives the cane is called the feed roll, and that which gives the final pressure the bagasse roll. The small plate, shown in the triangular space between the rolls, serves to conduct the partly pressed cane through the space to the entrance between the main and bagasse rolls. It is called the "returner" or guide-plate.

Mills are either "horizontal" or "vertical," referring to the position of the axis of the rolls when the machine is run. Steam and water power mills are usually made horizontal; those propelled by animal power vertical, though the latter are sometimes put in a horizontal position. Whatever may be the plan of construction, cane mills, to be effective, must possess certain essential qualities, which may be here referred to in general terms before proceeding to notice the different styles separately.

Strength and harmony of parts.—Cane mills are frequently subjected to sudden and unusual strain many times greater than they are required to support in ordinary plain work. The accidental entrance of a piece of iron or other hard substance between the rolls is not unusual, causing the sudden stoppage of the mill, and exposing it to the momentum of all the machinery connected with it, frequently including a heavy fly-wheel. Gorging and stopping the mill with an undue supply of cane is a common occurrence. From these and other causes accidents to cane mills are frequent. Adding to the weight of metal in the mill indiscriminately will not of itself secure the machine from accidents. An adequate amount of metal is, of course, required, but it is, perhaps, rare that mills are deficient in the quantity of material used if that which they contain were appropriately distributed, and the various parts properly adapted to each other. One of the most common and, at the same time, least suspected causes,

not only of breakage, but of undue resistance and wear, is the absence of an exact commensurable relation between the different rolls. The circumference of the rolls, relatively to each other and the connecting gearing, is frequently such that the surface of one roll must necessarily slip on the surface of another from half an inch to an inch with each revolution, and this must take place while the machine is under heavy strain, supporting all it was designed to bear in the legitimate work of pressing the cane. If to this appropriate service is added the strain required to overcome an undue and unnatural resistance the mill must break, or otherwise continue to work at a disadvantage, and with a loss of power even more disastrous than a break, provided the latter led to the abandonment of a worse than useless machine. If the rolls purport to be of the same diameter they should be exactly the same, and this should correspond with the "pitch-line" of the gearing; if one roll purports to be a half or a third larger than the others, and they are geared to run thus, the peripheries should be exactly commensurable upon the basis.

Bracing.—The housings or iron frame-work of a mill require to be firmly stayed. If supported upon a wooden frame-work of any kind it should be evenly and firmly secured thereto, and the latter well braced. With vertical mills mounted on posts, as is customary, several feet above the ground, the posts should enter the ground as far as they project above it, and be diagonally braced as firmly as possible. Numerous accidents, involving delays and often the loss of a crop of cane, occur from neglect of this precaution. The machine is thrown into a "twist," subjecting the parts to unnatural strain, almost necessarily causing a rupture somewhere.

Facility of adjustment.—The proximity of the surface of the rolls to each other is regulated usually by temper screws operating against the journal boxes of the two minor rolls. When the rolls are adjusted to receive a certain amount of cane, less than the quantity provided for in the adjustment, they will allow the cane to pass through only partially pressed, while more will, perhaps, clog and stop the mill. The means of adjustment should be convenient of access, and of such a nature as to remain fixed when properly set. Keys are sometimes used. They are apt to work loose. The point of bearing upon the back of the journal box, whether set screw or key, should be central, or at least no nearer the outer than the inner end of the journal box.

Flanges.—To prevent the cane while passing through from spreading out over the ends, and escaping from between the rolls, it is necessary to make the rolls several inches longer than the required working face, or employ a projecting flange upon each end of the main roll, between which the peripheries of the minor rolls work, the latter being made large enough to fit snugly between the flanges.

For small mills it is better to employ flanges, as, in the other case, the portions of the rolls which run naked, or nearly so, carry around a part of the juice, and that is, to some extent, reabsorbent by the pressed cane or bagasse as it leaves the rolls. In large mills, having rolls several feet in length, flanges are relatively less important.

Attempts have been made to work the rolls so snugly between the housing plates that the latter would serve the purpose of flanges to retain the cane between the rolls. They have utterly failed after causing immense annoyance. If no flanges are provided, allow two or three inches at each end of the rolls to run naked.

Journal Boxes.—The surfaces against which the journals work should be of brass. The various alloys known under the general name of "white metal," when composed, as is frequently the case, mainly of zinc, are not suitable for sugar-mill boxes. Iron boxes are very unsafe. If exactly and smoothly fitted to the journals, and if kept flooded with oil, and entirely free from sand or gritty matter, they may run without heating, but it is practically impossible to

render them entirely secure. The brass boxes should be accurately fitted to the journals, and not allowed to pinch at the edges, which would exclude the oil. They may be enclosed in a heavy cast-iron shell.

Lubricating.—In vertical mills for horse-power, a class of machines which have come into extensive use since the introduction of sorghum cane, no feature in their construction has given more trouble than the means of lubricating the lower journals. This will be more particularly referred to hereafter. The importance of having the bearings, which support heavy pressure, well lubricated, is sufficiently apparent. For this good oil should be used. Lard oil is good enough, but is liable to chill in cold weather. When conveyed through tubes of considerable length they often become stopped with the chilled oil, deceiving the operator, and, perhaps, in a short time causing his journals to be cut and his machine greatly injured. To render lard oil fluid, mix a small quantity of coal oil with it, using no more of the latter than is necessary to secure perfect fluidity at the time it is required.

Guide-plate, or Returner.—This, as has been explained, is the plate which is supported in the triangular space between the rolls, and serves to conduct the partly pressed cane from between the feed-roll and the main roll to the entrance between the latter and the bagasse roll. The office it performs is not apparently difficult, but it is nevertheless important, and its operation is frequently so imperfect as to allow the cane to accumulate in the space, clogging the mill and causing provoking delays. This plate should be adjustable, with its dividing edge resting firmly against the periphery of the first roll, to allow the sheet of partly pressed cane to pass through.

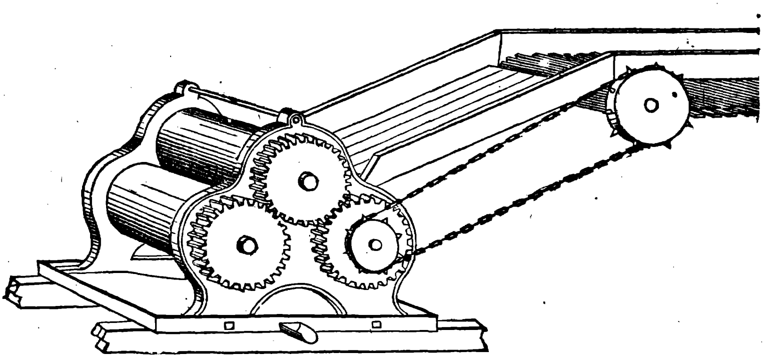
Speed of Rolls.—As the diameter of rolls varies in different mills, it is common to compute speed with reference to the surface travel of the rolls per minute; or, what is the same thing, the speed at which the cane passes through the mill. From twenty to thirty feet per minute is generally regarded most appropriate. Experiments upon an extensive scale have been made with tropical cane to determine the most effective speed. Twelve feet per minute was found to give a greater yield of juice than any higher speed. But, as will be understood, a machine moving at the rate of twelve feet per minute must have size and strength twice as great as another moving at twenty-four feet per minute, in order to perform the same amount of work in the same time. Hence, in the trials above referred to, a speed of eighteen or twenty feet per minute was considered to be practically the best, considering the greatest economy in machinery, in power, and in effective results.

Vertical mills operated by animal power, applied direct, have a speed due to the circumference of the master roll and the rate at which the animals move, say three revolutions per minute; or, with a roll twelve inches in diameter, a surface speed of nine feet; eighteen inches in diameter, thirteen and a half feet, and so on. This is a slower speed than might be employed, but it must be remembered that the capacity of these machines is limited by the capacity of the animal or animals which operate them. If the speed were increased, the quantity of cane fed at a time would require to be reduced to be adapted to the power, and in the end the same practical results would be obtained. This will show that the arrangements employed by some manufacturers to increase the speed of this kind of mills by extra gearing are useless. A given amount of power applied to a mill will produce the same practical result in a given time, whether the travel of the cane through the rolls is at the rate of twelve feet per minute, or, with half as much cane, twenty-four feet per minute. The sum of the work performed and of the resistance is substantially the same in both cases.

Cane and Bagasse Carriers.—Horizontal mills of large size are most conveniently fed by the endless apron called a cane-carrier. The construction and management of these are very simple, and should be such as to give the operator

little trouble. As commonly made they are needlessly expensive. Purchasers may safely stipulate for an apron or carrier, made with two endless straight linked chains, carrying slats of an appropriate length, one to every other link; the ends of the slats shouldered down and entering the links a short distance, and being held therein by a wooden pin in each. The apron is supported and carried by flanged wheels, fixed at proper distances apart upon shafts, one of the shafts being placed near the mill, and the other at the outer extremity of the apron. A chain band, adapted to a chain wheel on the end of the feed-roll shaft, and leading from thence to a similar wheel upon the end of the flange-shaft nearest the mill, communicates motion to the apron. It should travel somewhat slower than the surface of the rolls.

Annexed is a cut illustrating a cane-apron, and showing the arrangement of the same in the mill:



Bagasse-carriers are made and arranged in a similar manner. Motion is communicated to them by a rope or chain leading from a sheave or groove pulley on the end of the bagasse-roll to a similar sheave on the end of the remote flange-shaft, being crossed on the way. This apron cannot be carried by applying the power to the near shaft, as the pull would be upon the under or slack part of the apron, and this would loosen the tension upon the flanges, allowing them to revolve without carrying the apron.

Juice Receivers.—Horizontal mills are usually, and should always be, supported upon a bed plate. This forms a pan to receive the juice as it leaves the rolls, from which it is conducted by a spout to a large tank or cistern.

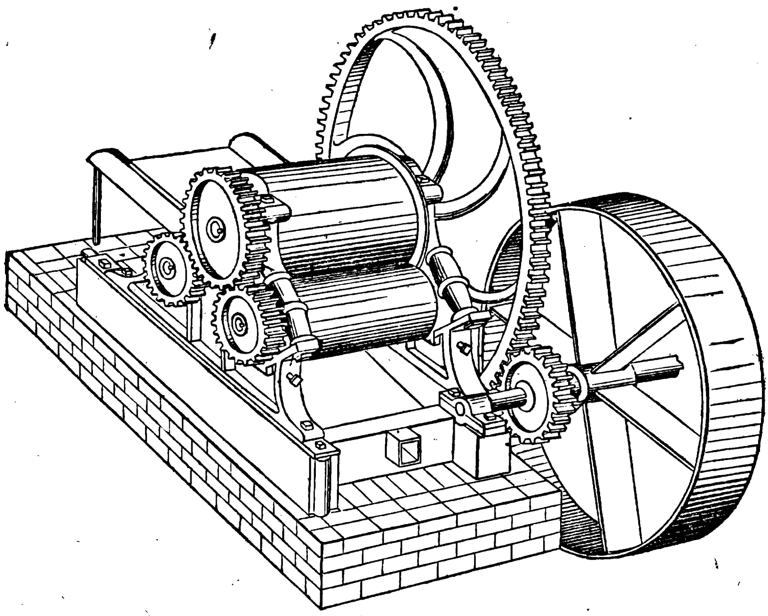
Vertical mills have a rim cast around the edge of the lower plate, by which it becomes a pan. The rim should be an inch or an inch and a half deep, to prevent the juice from overflowing; the spout amply large to carry off the juice, and the construction and arrangement such as to allow the plate or pan to be conveniently cleaned of the trash which accumulates. A ledge as high as the rim should be raised around the openings in the plate for the shaft, and provision made to prevent the oil from the journals flowing into and mixing with the juice.

HORIZONTAL CANE MILLS.

These machines are made of greatly varying dimensions. The largest of the kind in the world is that recently constructed in Glasgow for the large sugar estate of Signor Zulueta, in Cuba. The rolls are seven feet long and thirty-six inches in diameter; the main journals twenty inches in diameter. It is propelled by a steam-engine, the cylinder of which is twenty-two inches in diameter and five feet stroke, working probably one hundred and fifty or two hundred horse-power. The cane is fed to this formidable machine by a carrier in

a sheet fourteen inches deep and nearly the whole length of the rolls. An opposite extreme, or very small mill of precisely the same style, is used in some places in the west, the rolls of which are only six inches in diameter and ten or twelve inches long. With two horses, working a separate horse-power connected with these little mills, they are capable of giving from sixty to seventy five gallons of juice an hour, but with a waste of power which will hereafter be explained.

Horizontal mills are most appropriate for steam or water power, as the horizontal position of the main shafts permits it to be conveniently connected with these motors. The peculiar mode of connecting the driving machinery with the mill must be governed by circumstances, as the mill will ordinarily be used in connexion with machinery already fixed and adapted to other purposes. But, in any plan that may be considered, the operator should select a position for the mill with reference to the passages or roadways by which the cane is received and the bagasse removed. Motion may be communicated by either belt or gearing. If a belt is used, it should be of considerable length, and run at a high speed on large pulleys. The length should not be less than fifteen feet, double (thirty feet) the speed not less than from thirty to fifty times the speed of the surface of rolls, and the width about one inch for each horse-power transmitted. Any of these conditions may be changed by making a compensating change in one or more of the others. The adhesion of a belt to its pulleys is limited, and unless it is worked well within that limit it will give trouble. The only way to avoid this is to give it speed, with sufficient length and width to cause it to hug the pulleys well. Of course, the rapid motion which it is necessary to give the belt must be reduced afterwards, before being imparted to the mill. This is done by back gearing.



When the premises will permit of such an arrangement, the mill may be run by a pinion on the shaft of an engine or other main driving shaft, gearing into a large wheel carried by the main or master roll-shaft of the mill, or the pinion may gear with a large spur-wheel on an intermediate shaft, and the latter carry a pinion gearing with a wheel or master roll-shaft, still further

reducing the motion if necessary. In large mills it is better to connect an intermediate shaft with the main shaft of the mill by a short coupling-shaft and couplings. In this arrangement the couplings, being loosely fitted, accommodate any slight variations from a true line or level between the mill and gearing frame which may occur by the sinking of the foundation or otherwise, and in case of undue strain, the couplings, being made purposely weaker than any other part, are the first to break, thereby securing the machine from any more disastrous rupture.

The power required to propel cane mills of any certain capacity should be here referred to, as the subject is one of the first to arise in the mind of the inquirer. The great difference in the real working capacity of different engines of the same stated or computed horse-power, and of the same engine under different conditions, render it difficult to give estimates as exact as are desired.

The capacity of a horse working upon a cane mill direct, that is, without intermediate gearing and unnecessary waste of power in friction, may be stated at *forty gallons of juice an hour*. This supposing the cane to be fresh and the machine in good order. The power of steam-engines and water-wheels being usually stated by the horse-power, it will, therefore, be proper to compute the capacity of these motors at forty gallons of juice an hour for each horse-power. If required to know the capacity in acres of cane per day, it may be assumed that twelve hundred gallons of juice is the average product per acre of good fresh cane. This will give as a result one-third of an acre per day of ten hours for each horse-power employed. An engine working fully up to its estimated capacity will rarely fall short of this estimate, and will usually exceed it.

HORIZONTAL MILLS FOR HORSE-POWER.

Mills of small size, adapted to two or four horses, and constructed upon the same general plan as steam and water-power mills, are in quite common use among sorghum operators. The modes of applying the power are various, and all, as may be here remarked, attended with an unavoidable waste, resulting from the impossibility of applying the power direct. Horizontal mills are supposed by many to be more conveniently fed or supplied with cane than vertical mills. This is probably not the case, but rather the reverse, when the operation is performed, as it usually is with small mills, by hand. Horizontal mills are necessarily more expensive than vertical mills of the same capacity, if the means of applying power to them be included. But more upon the comparative merits of horizontal and vertical mills for horse-power hereafter. Propelling horizontal mills from an endless chain or "railway" horse-power is one of the most objectionable modes practiced. The apparatus is usually constructed to communicate a high velocity to the driving shaft, adapting it to other and very different purposes. This necessarily absorbs a large amount of power in friction. The speed thus accumulated must be reduced by gearing involving a still further waste of power before it can be applied to the mill, so that in the end not more than one-half or three-fourths of the power exerted by the animals is made available, the remainder being absorbed in giving motion to the unnecessary appendage.

Another form of horse-power, that used for threshing and other farm purposes, propelled by sweeps, is only a little less objectionable than the endless chain, as it is constructed, like the latter, to give a rapid motion to the "tumbling shaft," which must, as in the other case, be reduced before being applied to the mill, involving a waste of power. The least objectionable, because the most direct, mode of working horizontal mills by horse-power is where the sweep is carried by a vertical shaft, and the latter carries a bevel wheel

gearing with a bevel wheel on the main shaft of the mill. The team in this case travels around the mill and interferes somewhat with the work of feeding and removing the bagasse. This may be obviated by extending the vertical driving shaft down through the floor into a lower or basement story. This has been found a practicable and very convenient arrangement. It will be more particularly referred to in connexion with the same arrangement applied to vertical mills.

Purchasers of small horizontal mills will find them made in two different styles, one with what are called "plate housings," and the other with "skeleton housings," similar to the large steam-power mills. In the former the strain is supported by the cast metal plates, and in the latter mainly by wrought bolts. The difference in the cost of construction is not very great, and it is obvious that wrought metal is much more appropriate for supporting a tensile strain than cast, besides the construction of "skeleton housings" mills renders them more convenient.

VERTICAL MILLS.

In these machines the rolls are set in a vertical position, and the main roll-shaft, extending up through the top plate, carries a "sweep-cap," to which the wooden sweep is secured. The team travels around the mill, and the power is, of course, applied *direct;* no intermediate gearing or extraneous machinery of any kind being employed. In applying animal muscle to the rugged work of crushing cane stalks, it would seem to be the dictate of both humanity and economy to impose no greater burdens upon the beast than are absolutely necessary. For this reason, in the vertical mill, as here described, all the power exerted is applied with the least waste to the work, and all made available in producing a useful result, as is obviously most appropriate. The speed of the rolls is of course slow, but, if they were more rapid, the quantity of cane passing through at one time would require to be correspondingly reduced, for at the speed they are operated the full capacity of the team is employed.

A simple three-roll horse-power mill would not seem to require any great degree of mechanical skill and judgment in its construction, and yet every manufacturer who has undertaken to produce them has found occasion for all of both that he could command. Not until recently have manufacturers succeeded in perfecting these machines so as to satisfy either themselves or the requirements of their patrons, and none have been so fortunate as to produce a new plan or style of mill without passing through one or more seasons of disaster and disappointment, alike vexatious to maker and user. As this class of machines was called into existence by the necessities of the northern cane business, and as they will probably continue to be the main reliance of the great mass of cane producers, a more minute reference to the particular points which require the attention of purchasers should be made.

The first feature of importance in these machines is *strength.* In this respect vertical mills from the first have been deficient. The business when commenced was experimental. Producers, desiring to avoid expense, required cheap machinery. Manufacturers were anxious to accommodate the demand, and both buyer and maker being ignorant of what the work required, the machines were adapted to the price and not the business. Broken mills, loss of cane, failures, and disappointments were the result. Mills were the next year strengthened, but the rapid increase in the production of cane threw a corresponding increase of work upon them, and again they failed. Again they were improved and strengthened, but insufficiently for the increased service imposed upon them, and they continued to fail, and this, in brief, has been the course of events with this class of mills from the first. But there has

come now to be a better understanding of what is required, and both buyers and builders are more willing to meet the condition which the work imposes

The weight of metal for a one-horse vertical mill should not be less than eight hundred pounds, for a two-horse mill twelve hundred pounds, and for a four-horse mill sixteen hundred pounds. The shafts should be all of wrought iron of good quality, the main shaft of a one-horse mill two and a half inches in diameter, two-horse three inches, and of a four-horse three and a half inches. The rolls are most secure when cast and shrunk on the shafts recessed in four places in each hub with deep *square* shouldered depressions—not V-shaped, as sometimes made. The vertical stay plates should have a good bracing at top and bottom, extending well around on the four sides of the machine, with four bolts connecting the top and bottom plates, bracing and confining the whole very securely in all directions. The sweep cap is better fitted to the top of the main shaft with a square eye, having an abundance of metal around the centre. The journal or bearing boxes should be arranged close to the hubs of the rolls, otherwise the shafts will spring slightly with the strain, presently destroying the fibrous structure of the iron, when it will break. The rolls should be "set up" with heavy screw-bolts, and not with keys; they should work in wrought-iron nuts, recessed in the casting back of the journal-boxes, and so placed that the point of the screws will press centrally against the back of the box.

The foregoing will suggest to the purchaser the principal points which require attention in determining the strength of a mill. He must, however, remember that the most perfect machine will fail if not properly "set up" and braced. No manufacturer should be held responsible for any breakage that may occur if the operator neglects this indispensable but very obvious duty.

The next point of importance in a mill is, that it shall run lightly. Theoretically it requires a definite amount of power to press a definite amount of cane to a certain degree. If the *power* were applied to the *work* in all mills with the same fidelity, the result in all would be alike. But this is not the case. In some it is transmitted through *media*, in which a portion is absorbed. This has been referred to. In the mills under consideration no difference of this kind exists. The power is applied in all alike, and in all direct, and yet the performance of these machines differs widely—as much as fifty per cent. in effective results. The cause of this difference, and the only cause, is unnecessary friction, produced by defects either in the plan of the machine, or its mechanical construction. This is a matter of importance to the operator, and yet, with all the information that can be given, he must be left in some uncertainty until he has seen comparative tests. Manufacturers are not slow to claim superiority for their machines in this, as in other respects, and will usually explain the points on which they claim advantage. When these are truthfully given, it becomes then a subject upon which the purchaser must exercise his judgment, and this, with most men engaged in the cane business, we think is adequate. The following, however, may be observed: the gearing should be regular, true, and smooth, and fit the boxes nicely; the latter should be of brass, the faces cleaned and trued to the journals with a file; adequate provision should be made for oiling; without this a machine must run heavily and soon fail; the weight of the rolls should be supported upon the lower ends of the shafts in oil-tight boxes, without allowing any contact of the rolls with the plates; and lastly, the surface of the rolls should be exactly commensurate with each other, and with the pitch line of the gearing.

Upon the subject of *convenience* much might be said. The operator will hardly fail to understand, that with short rolls, such as are used in v[illegible] mills, the main roll should be flanged; the journal boxes should be remo[illegible] the necessity of removing the gear wheels, which are frequentl[illegible] shaft so snugly that they cannot be removed without breaki[illegible]

accomplished by placing the gear wheels between the plates, leaving the boxes accessible without difficulty, and also enabling the mill to be taken entirely apart with ease. The lower plate should have a deep rim to form a juice pan, and a large, convenient exit spout for juice. Mills should always have a feed-box, or a hopper-shaped mouth, through which the canes are fed to the rolls; this preserves the canes in an even, vertical rank, presenting them in a uniform body to the action of the roll. The facilities for oiling, for setting up the rolls, as before spoken of, and for taking apart the machine and putting together again, all require attention.

The objection sometimes made to vertical mills, that they are not so conveniently supplied with cane as horizontal mills, may be noticed here. In feeding these mills the cane should always be presented to the upper part of the rolls, the large ends first; the outer ends should rest on a table or cross-bar just level with the lower end of the rolls; then, as the canes pass into the mill, they leave the upper end, gradually inclining down until a space is afforded at the same place for another handful of canes; these, as they are carried in, incline down in the same way, and so on, always leaving the upper part of the rolls vacant, and affording a place, and always the same place, for the feeder to supply. The outer ends of the cane hanging down and resting upon each other, of course fill the lower part of the feed-box, and make room above as fast as their diminished size permits them to concentrate. This may not seem an important matter, but it is by no means insignificant. A laborious occupation, which requires to be performed almost as regularly and unremittingly as the vibrations of a pendulum, is facilitated or rendered intolerably burdensome by differences which the inexperienced may very naturally regard as trifling. Let the "feeder," who has been toiling for hours on a vertical mill where he mechanically and almost unconsciously thrusts his handful of cane into the same opening in the upper part of his feed-box, be required to feed the same amount of cane with the same regularity to a horizontal mill, where, if the work is properly performed, he must, with each handful of cane, inspect the whole length of the rolls, and perform the mental operation of deciding where each stalk should be presented, and he will soon testify upon the question of convenience unhesitatingly in favor of the vertical mill. But the work of feeding is frequently performed by young persons, or by hands who cannot be depended upon for unremitting attention to their duties; in such cases, it becomes an important consideration with the proprietor to have those arrangements which will secure him against the results of carelessness, awkwardness, or inattention. In this respect the vertical mill has vastly the advantage of the horizontal, and is so regarded by those who have had experience with both.

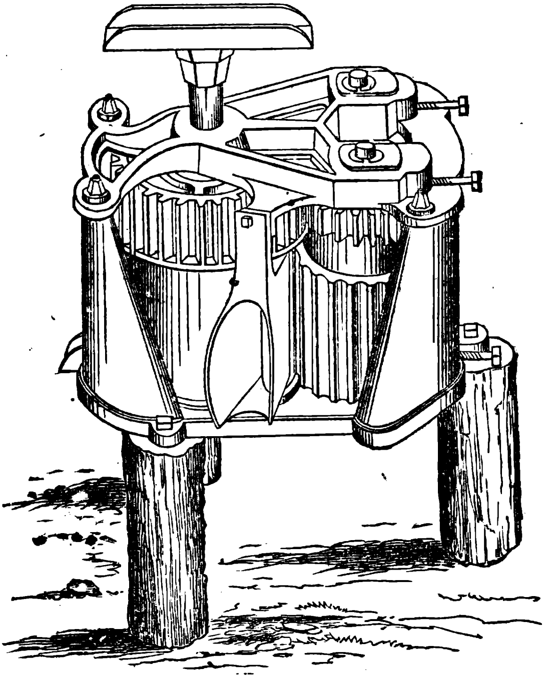
With reference to *durability* it is only necessary to say that a good mill properly worked should last for a generation, the only part requiring renewal being the bearing boxes.

The *capacity* of mills propelled by horse-power applied direct, as in vertical mills, has been stated in another place at forty gallons an hour for each horse. This refers to cane in its ordinary state, worked as soon as cut, and supposes the team employed to be alternated with another every two or three hours.

While the size of the mill and apparatus will, in general, be selected with reference to the quantity of work to be performed, the operator will not forget that it requires a hand to supply the cane to a one-horse mill, while a two or a four-horse mill requires no more. The same is true of much of the other work connected with the business. But with many the question of cost will determine the selection of an outfit, and although strict economy might dictate the [illegible] that which is most complete, the ability to do so is not always [illegible] uch cases the purchaser is obliged to take counsel of necessity, [illegible] iomy. But even then the buyer may, by a knowledge of what [illegible] res, preserve himself from being deluded. He may, at least,

avoid the mistake into which many are led, that of regarding a machine as cheap because it contains a large amount of metal for the money, when, in fact, with many so-called cheap mills, *avoirdupois* is their only merit.

The accompanying engraving is an illustration of a new style vertical mill in which an attempt is made to embody all the improvements which have been suggested by experience, and to furnish a complete vertical cane mill.



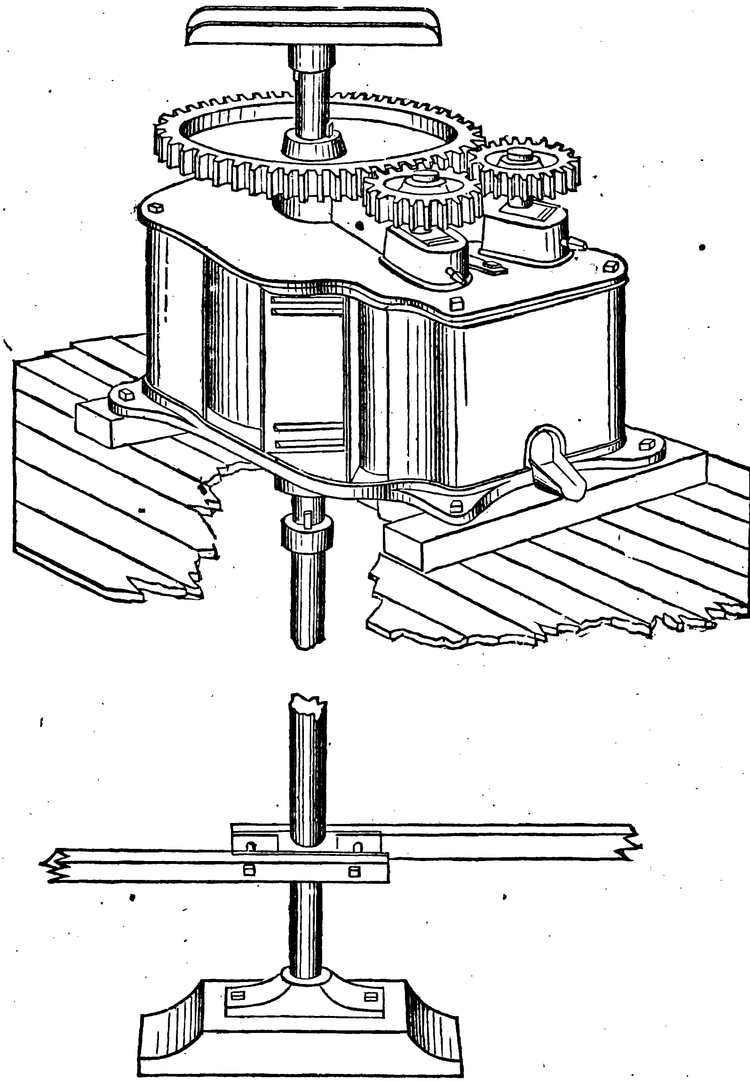
In this machine the gearing is placed between the rolls, giving access to the boxes; the small wheels are lapped, bringing the minor rolls close together, and dispensing with the guide plate or "dumb returner;" the main roll has a wide flange; the sweep cap has a square eye fitted to the squared end of the main shaft, removable by hand; the weight of the rolls is supported upon the ends of the shafts in adjustable oil-tight boxes; the feed-roll is fluted to facilitate the entrance of the cane to the mill; the top and bottom plates are diagonally braced as represented, and the construction of the whole machine is such that the mill may be taken entirely apart by simply unscrewing the corner bolts, no keys being used in any part of the machine.

VERTICAL MILLS WITH SWEEP BELOW.

To avoid the inconvenience of having the team travel around the mill, interfering with the passing to and fro with cane and bagasse, the plan has been adopted by one manufacturer, at least, of prolonging the main shaft of the mill down through the floor, and there coupling it with another shaft which continues down and rests in a step on the floor of a lower story or basement. The sweep is attached to the shaft below, and the team is thus removed from around the mill, leaving the space unobstructed. When the premises in which the mill is situated is on a side-hill, affording access to an upper and lower floor from the ground, this is a very convenient arrangement, as the cane can be delivered to

the mill above, and the juice therefrom conducted without pumping or elevating to tanks and pans below.

An illustration of a mill arranged upon this plan is here given, the mill being of a different style from that last presented. The other is, however, susceptible of being worked in the same manner, and is so made when wanted.



STEAM AND HORSE POWER COMPARED.

When the business is conducted upon a scale of any considerable magnitude, requiring eight or ten horse-power, steam is the most economical. Water-power is, of course, cheapest of all when it can be made available. It will be apparent that if the cost of an engine and its adjuncts is the same as the potential equivalent thereof in sound horse flesh, and the wear and tear, the endurance and the

cost of attendance, the same, all of which may properly be assumed to be the case, then the relative cost of power from the two sources will be precisely as the relative cost of the fuel or food which they consume. In other words, the question is, simply, how much power is afforded by a certain number of dollars expended in wood and coal compared with an equal amount expended in hay and oats.

With the general run of farm engines it is proper to estimate that eight pounds of coal are consumed per hour for each horse-power exerted. This will give for an engine working effectively ten horse-power ten hours the following: $10 \times 10 \times 8 = 800$. Say 800 pounds, or ten bushels of coal, consumed per day of ten hours, performing the work of ten horses. It provides for good continuous work, equal to the raising of 330,000 pounds one foot high every minute, or, in another form of expression, to a direct pull of 1,250 pounds at the rate of three miles an hour. Few teams of ten horses are really able to exert this force for more than six or eight hours a day; but let it be supposed that they are able to perform it for the full time, equal to the work performed by the engine, it is then only left to determine the cost of keeping the horses compared with the value of 800 pounds of coal, or, say, two-thirds of a cord of wood, which it is near enough to call an equivalent for the coal.

It is probable that if the keeping of a farm horse, including all the grain, hay, and grass he consumes, were computed in oats, it would amount to about one bushel for every day worked. The excess accruing from this on working days would not more than carry him through the idle days. Then the cost of the work of two horses is equal to the cost of ten bushels of oats for all working days, while the cost of producing ten horse-power with the engine is ten bushels of coal or the equivalent thereof, two-thirds of a cord of wood. This gives as the cost of the two kinds of power relatively—

$$\text{Steam-power}: \text{horse-power} :: \frac{1 \text{ bushel coal}}{\frac{1}{12} \text{ cord wood}} : 1 \text{ bushel oats.}$$

It would be easy to show that the minor expenses for the engine, such as oil, waste, packing, &c., are about balanced by the blankets, blacksmithing, curry-combs, &c., for the horses.

EVAPORATING.

Fuel is a very important item in the cost of evaporating, hence economy in its use demands attention. With regard to the means of securing the greatest economy much obscurity and many fanciful notions exist. Some of the latter have been developed in the form of patented improvements with which the unwary are often beguiled. In the outset of this subject it may be as well to remark, that to convert a given quantity of water to vapor, a given and unvarying measure or quantity of heat is always required. The law with reference to this is as fixed and immutable as the law of gravity. No device or assumed invention of man can modify or evade it. Even in the vacuum pan, where boiling goes on freely at a temperature of 150°, the amount of heat absorbed by every measure of water evaporated is the same as in an open air vessel, or in a steam boiler under pressure of many atmospheres. Hence the only advantage which one evaporating pan or apparatus can have over another must proceed from greater perfection in combustion, or in preventing the waste of heat resulting therefrom. By keeping this in view the relative economy of any plan or mode of evaporating over another may be readily determined.

In evaporating by steam, the exact quantity of heat taken up in the steam boiler is conveyed over and given out in the evaporator, less the small amount lost on the way by radiation, and the amount of water evaporated thereby in the pan is precisely that which would have been evaporated had the juice occupied the place of the water in the boiler. When combustion is more complete, and

the initial heat more perfectly utilized under a steam boiler than when the same quantity of fuel is consumed under an ordinary evaporating pan, the steam process is the cheapest. When the reverse is the case, the other is cheapest.

The facilities and convenience afforded by steam is another matter, and will be referred to hereafter.

It cannot be denied that the fire evaporators in ordinary use, in many cases, consume an undue amount of fuel for the quantity of water evaporated. Though the capacities of fuel are so variously stated, and the results under different circumstances so unlike, that no certain basis for what should be accomplished can be given. An approximate estimate may, however, be given accurate enough to show the necessity for great improvement in furnaces, or for the more general use of such as are constructed to consume fuel economically,

Under favorable circumstances the consumption of one pound of bituminous coal is made to evaporate ten pounds of water. There is no good reason why our evaporating pans should not give eight pounds of water evaporated for each pound of coal. This would give about ten hundred and seventy-five gallons of water evaporated with twelve hundred pounds of coal—supposed, for illustration, to be equivalent to one cord of wood. This would give as a result in sirup, when the reduction is ten gallons of juice to one of sirup, one hundred and nineteen gallons; when the reduction is eight to one, one hundred and fifty-three gallons; and when six to one, two hnndred and fifteen gallons. Wood is the fuel most commonly used for evaporating by operators, and it is quite within bounds to say that the average quantity of sirup made per cord of wood does not exceed seventy-five gallons, or but little, if any, more than half the quantity which should be produced.

The means of economizing fuel to the utmost extent may not be within reach of many, and it would be difficult to give briefly the information which would be required. A few suggestions may, however, be made.

A dull, sluggish fire is wasteful. The combustion should be urged by a good draught, to secure which the chimney should be large, and the height equal to the length of the evaporator if the latter is short, and considerably more in proportion if the evaporator is long, say ten or more feet. All angles in the flue or passages should be "goose-necked" or rounded, and the area at the turns preserved uniform with the area of the flues. The walls of the furnace and the doors should be tight, excluding cold currents. The grate bars should be kept covered with fuel to prevent cold air from entering and diluting the heat. The passage under the pan should be as shallow as possible without unduly obstructing the draught, and it should be gradually lessened in depth, commencing at the after end of the grate bars until it enters the chimney. Sound, well seasoned wood will evaporate nearly a third more water than green wood.

Some of the portable evaporators, made and sold with sheet-iron furnaces, use wood economically. They are generally made to be lined on the inside with brick, which retains the heat, and the casing of iron effectually excludes cold air.

STEAM EVAPORATORS.

In accordance with what has been said in reference to specific measures of heat being always required to evaporate given measures of water, it will be understood that when water is converted to steam in a steam boiler its heat, when conveyed over and given off in the evaporating pan, will suffice to convert a similar quantity of water to vapor therein; the steam in the coil or pipes, being deprived of heat, is returned to water, and the same quantity of water in the evaporator receiving the heat being converted to steam, the heat being simply transferred from one to the other, directly inverting their states or conditions. After the water or juice in the evaporator has been raised to the

boiling point, the quantity of condensed water formed in the pipes is the exact measure of water expelled from the surface of the pan in the form of vapor. It will thus be seen that, for every gallon of water evaporated in the pan, a gallon of "feed water" must be supplied to the boiler, and there converted to steam. In addition to this, the boiler must be supplied with feed water enough to make up for the loss by radiation from the different parts of the apparatus, also for the heat required in raising the temperature of the juice to the boiling point. If the juice is at the freezing point, 32° F., it will require nearly one-fifth as much steam water to raise it to the boiling point as there is juice in the evaporator; if at 69° F., it will require one-seventh as much. In calculating the capacity of steam boilers and pumps for supplying feed water to the same for evaporating, it is convenient and quite correct to estimate that the amount of water required to pass through the boiler will be the same as the juice passed through the pan or evaporator.

While the use of steam cannot be urged on the score of economy in comparison with a properly arranged fire apparatus, it has advantages in some other respects which may be noticed. It is in reality a medium by which heat is rendered almost perfectly portable. It may be conducted considerable distances with but very little waste; it may then be applied to its useful purpose, in the course of which its intensity may be nicely regulated; it may be cut off and again applied at pleasure, and all by operating a simple hand-valve. Nothing could be in these respects more perfectly adapted to boiling cane juice. But, to secure these advantages, considerable outlay and preparation are required; a steam boiler or set of boilers must be provided, pipes and valves must be arranged, an adequate supply of feed water and complete arrangements for supplying the boiler must be made; in addition to which, constant care and attention are required to insure safety. There are, moreover, objections to its use on another score, which will be noticed hereafter. Steam evaporators are commonly used in connexion with a steam-engine, which operates as a force-pump to supply the boiler with water. It is, however, practicable to return the condensed water directly from the coil to the boiler. To accomplish this, the evaporator must be placed at an elevation of not less than ten or fifteen inches above the boiler, and the coil must be so arranged that the water will flow through and descend to the boiler by its own gravity. The pipes for this arrangement should be larger, and more heating surface will be required than when the condensed water is discharged in the ordinary way into a tank, as the water of condensation will pass off sluggishly, leaving the pipes partly filled, reducing by so much the space for steam and the heating capacity of the coil. Various devices, some of them automatic, are used in place of a force-pump for supplying water to the boiler; but, as they cannot be depended upon without constant attention, and as their failure to act for even a short time might result in disaster, they are not recommended to inexperienced operators.

If a pump is used, its capacity must be four or five times as great as would be required to supply water for the engine alone; that is, it will require from *three to five times as much steam to evaporate as to grind the juice.* The exact proportion for each will depend upon the quantity of the juice and state of the cane.

STEAM JACKET EVAPORATOR.

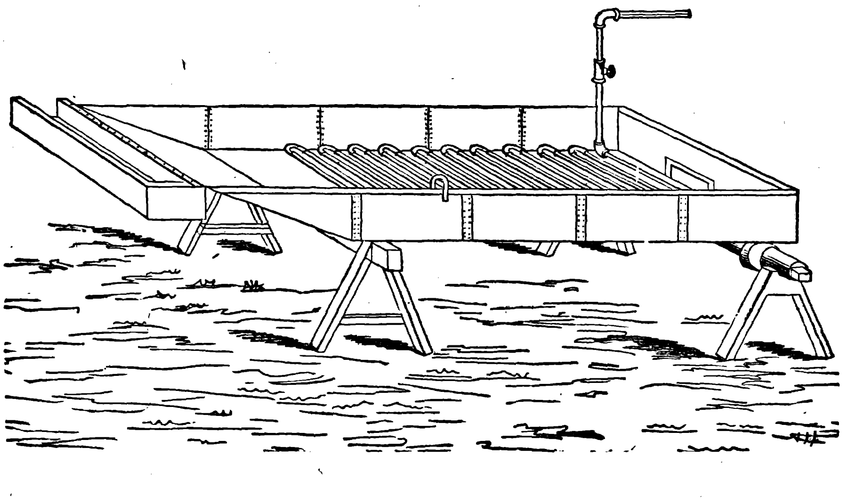
One of the oldest forms of steam evaporators consists of a vessel, generally of a hemispherical form, contained within another of larger size and similar shape, affording a narrow space between the two, into which steam is admitted for heating or evaporating fluids contained in the inner vessel. This style of evaporator is almost entirely superseded by the steam-coil, which is cheaper,

safer, and affords much greater amount of heating surface in the same compass. It would be hardly necessary to refer to this style of evaporator, if it were not for the persistent desire manifested by many operators for a plain flat pan with a steam space below. To sustain the pressure of steam in such a pan numerous stay-bolts would be required, reaching through and confining the two plates; and no number would be sufficient to hold the flat bottom perfectly level without making the metal very thick, and this would prevent the rapid transmission of heat. Moreover, the unequal expansion and contraction would cause the apparatus to leak steam. Altogether the obstacles are so numerous that, however desirable such a pan may be, it is not likely to be generally used.

STEAM-COIL EVAPORATOR.

This term is applied indiscriminately to evaporators with steam-pipe, whether arranged in the form of a coil, or, as more commonly used, in a rectangular series. In some the steam is admitted through a main pipe, from which others lead off at right angles, terminating in a similar main, which receives and carries off the condensed water of all. In other cases each branch-pipe has an independent waste-pipe. Still another, and the most convenient plan, though not without some objections, consists in admitting the steam at one end of the coil and allowing it to pass progressively through the whole, driving the condensed water, which it will do, though imperfectly, before it. The difficulties in this plan are produced mainly by the sudden expansion of the parts into which the steam first enters, while the others remain cold, thereby straining the connexions and causing leakages at the joints. The best security against this is to use rather short pipes, even at the expense of a greater number of "return bends." When the pan is long the pipes may be arranged transversely. This plan has other advantages, which will be mentioned.

Iron, brass, and copper pipes have each been used for coils. By far the most common is iron, for the sufficient reason that it costs less than half as much, and is nearly as good. Iron pipes may at a slight expense be ground smooth on a stone or emery wheel, removing the scale, when they can be cleaned as easily as copper or brass, and are exactly as good, except that the thickness of metal is greater and the heat not so rapidly transmitted; hence a large area of heating surface is required. The black, inky color imparted to sirups by new iron pipes and sheet-iron pans results from the scale, (black magnetic oxide,) which is dissolved off by the acid of the juice. This, if previously removed, will obviate all important objections to iron.



The preceding cut is a representation of a steam-coil evaporator, which will serve as an illustration of the most important points to be considered in con nexion with this subject.

The pan is made of sheet iron, number 18 or 20, except the vertical end, which is cast and furnished with a large opening, closed by a sliding gate worked by a lever. The opposite or front end is scow-shaped, and to the upper edge a large trough is secured to receive and conduct away the scum. The length is twelve feet, width four and a half feet, depth of iron sides one foot. The sides should be continued up with wood, secured to the iron by screws, about another foot. The pan is supported at the front end on a trestle or framework, and at the after end on a round cross-bar carried in eccentric bearings so arranged that, by rotating the bar half around, the end of the pan will be lowered several inches.

The coil consists of fifteen pipes one and a half inch inside diameter, the same number one and one-fourth inch, the same one inch, ten of three-fourths, and five of one-half inch, all four feet long and arranged transversely, beginning with the largest pipes at the after or square end of the pan. This will make in all sixty pieces, and afford, with the return bends, one hundred superficial feet of heating surface, capable of evaporating, with steam at sixty pounds pressure, one hundred gallons of water in an hour. The front end of the pan, when in position for boiling, is set one inch lower than the after end. The pipes rest fair on the bottom, except the little space they are held up by the return bands. The steam enters the coil at the after end by a vertical pipe, in which is a globe valve, and the pipe is so connected with the main, either by a flexible tube or a crank joint, as to allow the after end of the pan, with the coil, to be lowered several inches without strain or injury to the joints. The small pipe which terminates the coil at the forward end turns up, and may be continued on to any convenient height to a tank overhead, or it may turn down over the edge of the pan and discharge below. This should have a through-way cask to regulate the discharge of condensed water. If proposed to return the condensed water directly to the boiler without a pump, nothing less than one-inch pipe should be used; the pan should also have a still greater inclination towards the front, and instead of turning the discharge-pipe upward, it should pass directly through the bottom or side of the pan and descend to the boiler, which, as before stated, must be ten or fifteen feet below the level of the pan when this mode is adopted.

In operating this evaporator a charge of juice, say one hundred gallons, is run into the pan. As soon as the pipes are covered steam may be turned on, at the same time the waste-water valve is opened just enough to carry off all the condensed water, but no steam. It will be observed that the inclination given to the pan will cause the condensed water to flow forward, assisted by the current of steam, into the small pipes, perhaps nearly filling them, while the larger will be kept almost clear of water. The charge of juice above specified would, if all admitted to the pan before commencing to boil, give about five inches in depth. If allowed to flow in while boiling is progressing, it should enter at the front end of the pan.

Owing to the greater amount of heating surface at the after end of the pan, and the entrance of steam at that point, boiling first commences and continues more violent there than at the opposite end. In fact, it is designed that for a short distance at the front end the juice shall not boil. The effect of this is to draw all the scum to this end, where it rests quietly until removed, which is done occasionally by raking it over the inclined end into the trough with a long-bladed wooden hoe. When the charge has been sufficiently condensed, steam is shut off, the after end of the pan lowered by rotating the eccentric support, and the sirup drawn off; the inclination causes it to run off quickly and clean. The cost of such a pan as this, at the present price of labor and

material, would be about two hundred and fifty dollars. This may be considerably lessened by making the pan of wood; but if this is undertaken, the utmost care will be required to make and keep it tight. It should be made of two-inch pine lumber, put together with screws and bolts or clamps, so applied that every joint may be closed and held by them. It should be then well painted inside and out, and if it is to be supported at the two ends, as has been described, it should rest on heavy longitudinal timbers, one under each edge and another under the middle, reaching from end to end. The alternate heating and cooling to which it is exposed will cause it to leak and swag and give immense trouble unless carefully guarded against. The plan of using wooden pans with thin metal linings, either of copper, tin, or zinc, has been tried. They will not answer. The metal expands by heat, crimps, cracks, and leaks, in all cases, giving excessive annoyance. There are many plans and arrangements for steam evaporators, nearly every manufacturer having one of his own. The plan above suggested is, in several respects, unlike any in use, and affords several advantages which will readily occur to the reader who has had any experience in working steam pans. It is given mainly for the purpose of illustrating a few points which require attention, and to afford a basis for those who contemplate using steam in their operations.

Whatever plan the operator may adopt, it should provide against injury to the joints by unequal expansion, also suitable provision for carrying off the condensed water, remembering that a coil half full of water is practically only half a coil. The arrangement should be such as to throw the scum to one part of the pan, and that part should be a "dead-head" or undisturbed by ebullition, and it should be so constructed as to allow the sirup and all of it to be discharged as suddenly as possible. The pipes should be convenient for cleaning within reach from end to end, and the pan so arranged that it can be well inclined towards the discharge end, so that water dashed in will readily flow off, carrying away all impurities which collect under the pipes. Any plan or arrangement in which these various objects are suitably provided for will be found good, and in the measure that they are overlooked or disregarded the apparatus will be defective.

The advantages afforded by steam are, as has been formerly remarked, in the convenience and facility with which the heat can be controlled. It is not more economical necessarily, and it offers no immunity from the results of ignorance or inattention. Sirup can be burned by steam as well as fire. There is, moreover, an important drawback to the use of steam pans with pipes, as now constructed, which may be referred to before leaving this branch of the subject.

Among all the many notions and theories with regard to the treatment of cane juice, a few are accepted universally as settled principles. One of these is, that *prolonged* exposure of cane juice to *intense* heat is injurious. The vacuum process, suggested by Howard in 1813, is regarded by all as an era in the history of sugar-making, for the reason that it provides for boiling at a low temperature. A discovery that would abridge the time in the proportion that the vacuum reduces the intensity of heat would produce the same or a similar result. If the excess of water could be expelled from the juice instantaneously, even if a temperature somewhat higher than the boiling point of sirup in open air were employed, no carbonizing of fecula or conversion of crystallizable to uncrystallizable sugar would be produced; and in the very proportion that the operation approaches the instantaneous, the injurious effects of prolonged exposure are avoided. Now, the time during which juice is exposed to heat in being concentrated must, with a given heating surface, be in proportion to the quantity acted upon in one body. In using steam with steam-coil heaters, (and we have no other kind,) the quantity of juice must be sufficient to cover the pipes, and this is much more than would be required to cover adequately

the bottom of a plain, flat fire-pan. For this reason the time of exposure and the injurious effects resulting therefrom must be greater with steam-coil evaporators than are necessary with properly constructed fire-pans.

The injury to sirup from prolonged boiling is much greater with our northern cane juice than with the juice of tropical canes, owing to the greater proportion of crude vegetable matter and mucilage they contain.

FIRE EVAPORATORS.

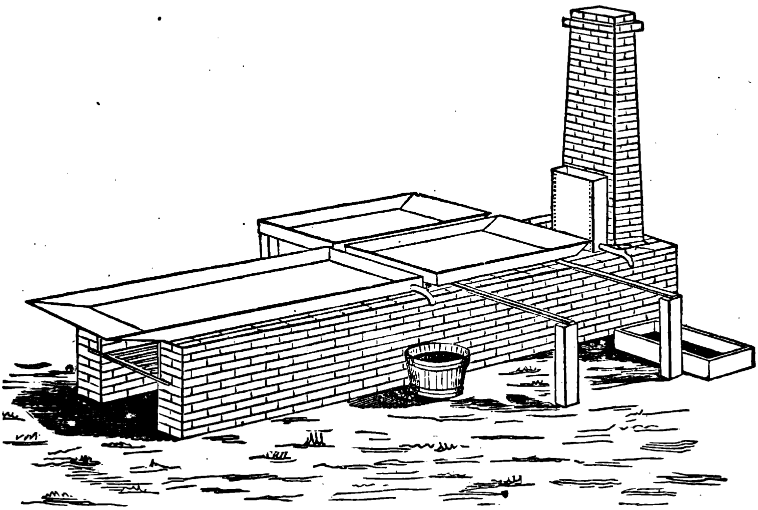
Operators in the northern cane very early discovered that the system of boiling pursued in the south, with a range of large kettles, in which the juice is exposed for a considerable time to the fire, would not answer. Prolonged boiling resulted invariably in producing a dark, tarry, offensive mass, while it was soon discovered that rapid boiling in a small body with the shortest possible exposure to the fire produced an entirely different and a better result. This led to the adoption of broad shallow pans, which are now universally used. In the use of these, two distinct modes of operating are pursued. One is where a quantity of juice is received into the pan at the beginning, desiccated and finished in one distinct operation, followed by another charge, which is similarly treated, and so on in successive charges and "strikes." This is called the intermittent process, in distinction from the other, which is "continuous." In the latter a constant stream of juice is allowed to flow into the pan, and the operation is so conducted that a constant stream of finished sirup is discharged, the green juice entering at one end of the pan, and the sirup flowing off from the other end.

INTERMITTENT PROCESS.

In this mode of evaporating a variety of plans and arrangements for convenience are employed. The pans are made in the form of a shallow box, with a common sheet-iron, galvanized iron, or copper bottom, frequently with flaring sides or shores, on which the scum collects and remains until removed at the convenience of the operator. These pans are frequently made with partitions, which divide them into two or more compartments, into which the juice, as it becomes defecated and partly concentrated in one, is successively transferred to the next. Pans for settling the juice or filtering it between the different stages are employed, some of them with advantage. In connexion with these are various devices for regulating the heat by means of dampers or hinged plates, so arranged under the pan as to cut off the fire from one part or section while being emptied of its contents. In some, passages are provided for the admission of cold air under the pan or section thus insulated. In some cases the first boiling and defecation is performed directly over the fire in a large pan, while smaller pans, easily removed by hand or by mechanism, are used over the after part of the furnace, remote from the fire; in others, the defecating pan is placed over the after part of the flue, and the finishing pan or pans over the fire, in the hottest place. Each plan has its advocates, and both are successful or unsuccessful, according to the care and attention bestowed. An apparatus somewhat extensively used consists of a large defecating pan and two finishing pans, the latter coupled together, and all arranged on the same furnace. The defecated juice from the large pan is supplied alternately to the smaller; one of the latter is at all times on the furnace; when the charge which it contains is finished, it is quickly slid or transferred off, and at the same time its mate, having been supplied with defecated juice, takes its place on the furnace; while the latter is boiling the first is emptied, cleaned, and re-charged, ready for the next charge. In this arrangement the finishing pans may be placed at the front end of the furnace, over the fire, or over the flue at the after end; if

the latter, the draught must be good, and the flue under the pan must be shallow, otherwise the heat will not be sufficient to produce active boiling.

An illustration is here given of an apparatus of this kind, with the finishing pans arranged over the after end of the furnace, and a water-tank still further in the rear.



A plan similar to this, except that the finishing pans are arranged forward, directly over the fire, is in use. The small pans are supported on wheels, which rest on a transverse track, and are moved on and off by a crank with a rack and pinion. The device for moving the pans is patented. Various other plans are employed for handling the finishing pans, all designed to give the operator perfect control of the work, and enable him to remove the sirup from the fire the instant it is finished.

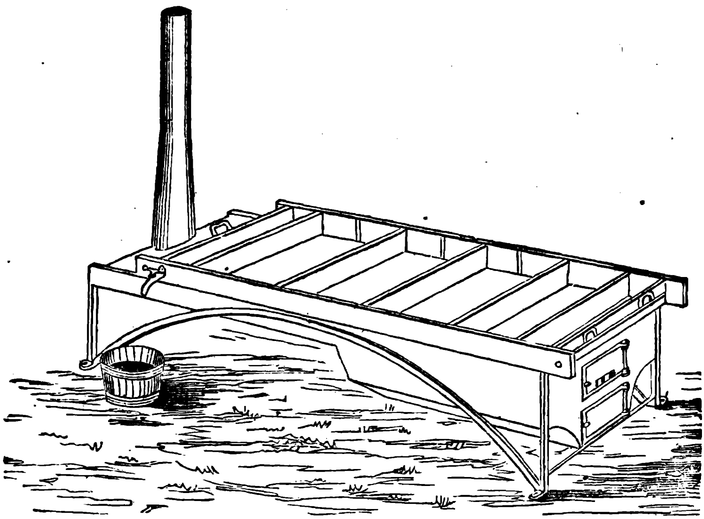
CONTINUOUS PROCESS.

It is difficult to resist the conclusion that, of all the ordinary modes employed for evaporating cane juice, the continuous process affords the greatest advantages. It, of course, includes the flow of the juice in a continuous stream over the bottom of the pan. This permits the supply to be so regulated and restricted that only a shallow body of juice is at any time exposed to heat. By this means impurities are most effectually expelled and the water evaporated with the shortest possible exposure of the sugar to the destructive action of heat. It is well known that dense solutions of even pure sugar are rapidly changed or degraded at the boiling temperature, but with our cane sirups the injurious effects of heat are increased many fold by the presence of free acids, salts, and impurities, which operate in conjunction therewith to produce the results.

In the continuous process two systems somewhat distinct are employed, which it is proper to treat separately. In both the great and paramount importance of rapid boiling in a shallow body, with brief exposure to the fire, is recognized. In one the juice, admitted continuously, flows in a thin stream directly from one end of the pan to the other, where it is discharged, either in a finished or partly finished state; in the other the juice, instead of flowing directly, passes back and forth through a series of transverse channels until it reaches the after or discharge end of the pan.

These two plans or systems are represented, the first by that which is most commonly known as the Jacobs pan, also by a pan invented by Dr. Harris, which operates upon the same principle, and the latter by the celebrated Cook pan. As the evaporators are generally known and designated by the names which have been given, it will not be improper to describe them in connexion with the individual names.

Jacobs evaporator consists of a plain rectangular shallow pan of any convenient length and width, made with a sheet metal bottom and wooden sides. The side pieces are grooved or notched on the inner faces to receive thin board partitions or divisions, extending from side to side, and separating the pan into any convenient number of compartments. These partitions rest loosely upon the bottom, allowing the juice to flow under from one division to the other, while the scum, which rises to the surface as the juice moves slowly along, is held back. The division boards fit loosely in the grooves in the sides, and may be changed or removed at pleasure. The accompanying engraving illustrates the principle upon which the evaporator is constituted.

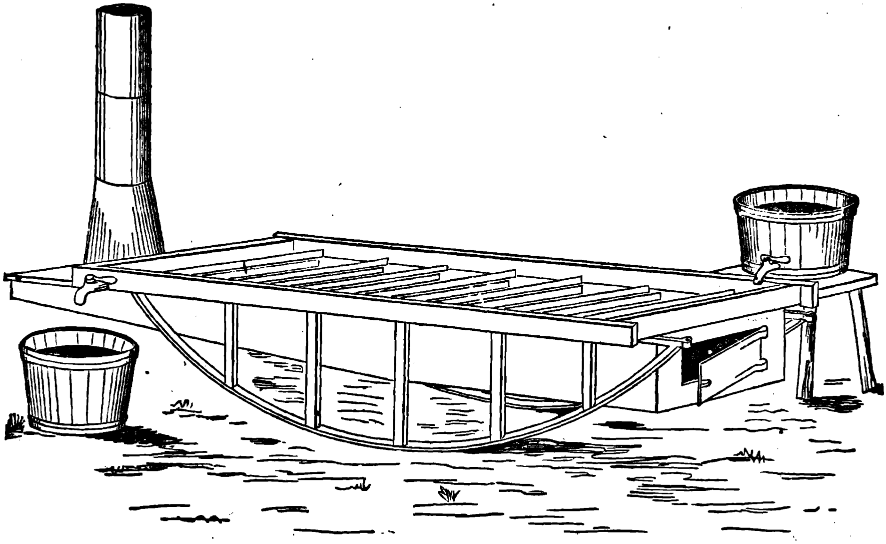


The juice is admitted in a constant stream at the front end, directly over the fire, and the supply is only sufficient to maintain a shallow depth of juice in the pan, from a fourth to half an inch—as little, in fact, as can be allowed without danger of the bottom running dry in uneven places. The boiling commences in the second division from the front, and is active in all the others except the last one or two. These are so remote from the fire that the juice is merely kept at the boiling temperature without ebullition. The heaviest scum rises and is removed from the first few divisions; considerably less appears as the juice reaches the middle divisions, and at last all trace of green scum disappears; but in the last one or two divisions, where the juice has a density of about 20° or 25° Beaumé, and where it is in a quiescent state, a filmy adhesive substance is thrown up. This is said to come off only at this particular stage in the process of concentration, and to be separated only by arresting the boiling and maintaining a temperature as near as possible at the boiling point without exciting ebullition. The partly concentrated sirup flows from this pan in a small stream, and is afterwards boiled down in separate finishing pans.

The Harris pan has the same general form and construction as the foregoing, except that the partitions are made of metal and riveted to the bottom, with openings at short intervals for the under flow of juice from one division or com-

partment to another. The furnace and the fire are so regulated that the juice boils through the entire length of the pan, and the sirup is brought off in a finished state, entering at one end in a continuous stream as green juice, and being discharged continuously from the opposite end as sirup. The partitions, being riveted to the bottom, serve to hold the thin metal of which the bottoms are usually composed even and level.

The accompanying engraving is an illustration of Cook's evaporator of the smaller size, such as are usually mounted with the furnace on rockers, as represented.



This pan is made with transverse ledges at short intervals, as represented, extending across from each side alternately nearly to the opposite side, forming a great number of transverse channels, opening each into the one next beyond at the sides, and, together, forming a continuous channel, through which the juice passes back and forth the entire length of the pan. The pan is made considerably wider than the furnace upon which it rests, the edges overhanging and forming what are called "cooling sides." The heat being applied at the centre, this part of the pan boils freely, while at the sides the juice is entirely quiet; but all the juice must cross the pan and be exposed to the heat as many times as there are transverse channels. The effect of the arrangement is to subject the juice to an alternate boiling and subsiding or cooling process from the time it enters until it leaves the pan as finished sirup. Ebullition commences in the second or third channel from the front, the scum being thrown to the sides and retained there while the juice flows around. The scum or impurities thrown up in each channel are prevented from flowing around with the juice by the mound or wall of form kept up through the centre. The quantity of juice admitted at the front end is so regulated as to supply a shallow body over the entire bottom, and the flow is so controlled that the juice, in passing through the channels from one end of the pan to the other, is fully concentrated and ready to be discharged as finished sirup. By changing the inclination of the apparatus, which is easily done by rocking it either way, the flow of juice through the channels is either accelerated or retarded as may be necessary. The larger sized pans of this description are made to be mounted on a brick furnace.

FILTERING JUICE.

As the green juice leaves the mill it contains a great quantity of suspended matter, consisting of the washings of dust and earth from the stalks, small fragments of cane, including numerous clusters of filmy cells, which form the pith of the cane. A large portion of these impurities may be removed by filtration, and this should receive careful attention, as their presence in the boiling juice, even should they be removed by subsequent skimming, imparts an offensive quality to the sirup. But practically only a portion of these impurities is taken out with the scum; a large quantity remains behind through all the stages of boiling, imparting to the finished sirup a dingy appearance. In addition to this, their presence in the pan is an incumbrance, rendering the soluble impurities, when coagulated by heat, less cohesive and more difficult to separate from the juice. The quantity of matter arrested, when filters are used, is so great that the filtering medium soon becomes clogged and inoperative, and the difficulty attending this is so great that most operators become discouraged, and content themselves with simply straining the juice through a coarse sieve, or a small mass of straw, trusting to good luck in the evaporator for the remainder. The following will be found a cheap and very effective plan for a juice filter, the use of which will be of great advantage: Provide a tight box or cask set in a grating a few inches up from the bottom, and arrange a spout or conduit, leading from the top down below the grating. Fill the vessel with clean straw, and let the juice from the mill descend through the spout into the space below. From thence it will rise up slowly through the straw, and may be conducted off by a spout from near the top of the vessel. By this arrangement the passage of the juice through the meshes of straw is slow, and the suspended impurities are nearly all retained, and without being so closely packed as to render the filtering medium impervious. In warm or damp weather the straw should be renewed daily, first drawing off the juice contained in the filter, through a faucet near the bottom, very slowly, to avoid disturbing the sediment which adheres to the straw.

DEFECATION.

This term is applied to the separation of green vegetable matter from juice in the first stages of boiling. The after processes applied to partly concentrated sirup are usually termed refining. Green juice, after being deprived of all floating matters, contains a large portion of coloring matter, vegetable albumen, and other substances derived from the crude sap of the cane. Most of these are in solution, and of course inseparable from the fluid until coagulated or taken out of solution. Our means of effecting this are very imperfect. An innocent and convenient defecating agent is the great want of the northern cane interest. The means employed with the comparatively pure juice of the tropical cane, which are only partially effective, are even less satisfactory when applied to the heavily incumbered juice of our canes.

A portion of the crude matter contained in the juice is separated by heat, and comes off in the form of green frothy scum. As the juice becomes more dense, and the boiling temperature raised, other portions separate and come off. Still later the green appearance ceases, and a yellow or whitish substance appears, consisting mainly of an amorphous gum. If the boiling be suspended at this stage, a tough pellicle forms upon the surface, supposed to consist of the same substance above referred to. This may be a principle derived from the juice, or it may be produced by the action of heat upon the saccharine matter, assisted, perhaps, by the interaction of some salts or acids contained. It is believed that this substance would continue to manifest itself upon the surface of the sirup so long as the solution remained exposed to heat. While heat is the most import-

ant effective agent in defecation, its action may be assisted by certain substances added to the juice. Of these, alkalies of various kinds are most commonly used, lime being the most appropriate. The action of these defecating agents is but imperfectly understood. It is only known that in an acid or an alkaline state of the juice certain foreign matters remain in solution, which, in a perfectly neutral state, are coagulated by heat and thrown off.

Cold defecation has been often attempted, but is not practiced by any operator in the north. Various substances containing tannin have been tried, but without important results. Within a few years sulphurous acid has been employed in treating the juice of tropical canes, and great advantages are claimed from its use. Some of the means employed for subsequently removing the acid have not been made public. It has not been employed with our cane juice except in the form of sulphite and bi-sulphite of lime, and then not for effecting cold defecation.

Slaked lime is the substance most commonly used throughout the world in the treatment of cane juice. It would hardly be considered practicable to work the juice of any tropical cane without lime, or some substance as a neutralizer. Our cane contains generally as much acid, and would seem to require the same treatment, yet many strenuously oppose the use of all neutralizing or defecating agents. State agricultural societies have, in more than one instance, stipulated that sorghum sirups and sugars offered for premiums must be made without the use of any chemical agent. The opposition to the use of lime with our cane juice has doubtless arisen from its imprudent or injudicious use. Nothing can be more absurd than the directions sometimes given with reference to the quantity to be employed. The only criterion to be employed in determining quantities is the litmus paper, and this is so easily obtained that none need be without it. And it should be remembered that, owing to some peculiar properties in our juice, and to the fact that it nearly always contains a portion of uncrystallizable sugar which readily enters into combination with lime, this substance, when used, should be applied with great caution. The particular time when lime should be added to the juice has been variously stated, but for many important, though not briefly explainable reasons, the following is given as the most appropriate time and mode of using it:

The juice having been accumulated in a wooden receiver, enough for a charge, or, if operating continuously, enough for an hour's run, is tested with the litmus paper. If very acid, it will turn the blue paper instantly to a bright scarlet; if less acid, a color bordering on crimson will appear; if still less, a pink, and so on through all the shades, till, with no acid, no change will be produced upon the paper. It is very rare that cane juice fails to indicate some degree of acidity. In case none is indicated no lime should be used. Fresh water slaked lime having been prepared in the morning, enough for the day, by being thoroughly mixed with water to the consistency of milk, is now to be stirred anew, and after standing a few seconds to allow heavy particles to subside, a definite measure of the same is added to the juice and stirred quickly until perfectly diffused. After a minute or two again apply the test paper, and if found that the hue first indicated has been distinctly modified from scarlet to crimson, or from crimson to pink, or from pink to purple, probably enough lime has been used. If no distinct change in the color of the paper is produced by the first application another measure of lime may be added, and its effect observed as before, and still another, if necessary, until the effect is produced. It is not safe to use the quantity of lime found sufficient for one volume of juice in another of equal volume, as the acidity is not likely to be the same in any two lots.

For convenience the litmus paper, which is usually sold in small sheets, should be cut into strips two or three inches long, and a fourth of an inch wide,

It should be kept in a box or drawer away from the air, and particularly from the vapor arising from the pans.

Other neutralizing agents, soda and potash, have been used both as carbonates and in a caustic state. Their effect is the same in neutralizing the acid, but they are not believed to be as effective as lime in coagulating the albuminous matters contained in the juice.

Bi-sulphite of lime is an effective defecator and decolorizer. Its most important function in cane juice is in arresting or preventing fermentation. It is most appropriately used by being allowed to drop into the juice as it flows from the mill at the rate of from one to two pints to a hundred gallons. As the substance is itself an acid, and as the sulphurous acid which it contains is changed by the absorption of free oxygen to sulphuric acid, a most active and injurious agent in the boiling sirup, it should never be used without the subsequent addition of quicklime in the manner above described.

Various other substances have been used with juice, but without results sufficiently important to command general attention. The use of eggs, milk, serum of blood, slippery elm bark, and other albuminous substances, belongs more properly to the after processes of refining, and they are too well understood in the domestic economy to require any explanation here.

FINISHING POINT.

If volumes were written upon this point the information would be of little practical value to the operator. The appearance of the sirup to the eye, the smell, the sound produced in boiling, the weight when thrown up in a familiar manner with the skimmer, the feel of a drop between the thumb and finger, the appearance when dropped into a glass of water—some one or more of these "signs" will be learned and adopted by every operator after a few hours' experience, and the indications they afford are only to be acquired by experience. Thermometers and saccharometers can only be used when boiling in large batches, permitting a deliberate test to be made, and, if boiled in large quantities, it is safe to say the sooner it is removed from the fire the better, as it cannot be finished without being rendered worthless. But few things with reference to the management of cane-juice have been fully demonstrated, and one of them is, that concentrating the sirup is always deplorable in its results.

COOLING.

Sirup retains heat a long time after being removed from the fire, and continues to suffer from its effects, unless means are used to facilitate its escape. If the boiling is carried on *continuously*, the small stream of sirup as it comes off may be conducted away through a broad shallow trough, and thus be cooled. But if finished in batches of even eight or ten gallons at a time, some artificial means should be employed to reduce its temperature down to 175° or lower before allowing it to rest quiet. For this purpose a wooden box may be made, four feet long, eighteen inches wide, and ten inches deep, with cross-bars five inches high, fitted, not perfectly tight, to the bottom at intervals of six inches. One end of the box should be pivoted or hinged to a support, and the other should have a cord or chain reaching up to one end of a lever arranged to work like a pump-handle. After running the hot sirup, say eight gallons, into a box of the dimensions given, the pump-handle lever may be worked to raise and lower the free end of the box moderately, causing the sirup to flow from end to end in short cascades over the bars, exposing a large amount of surface continually to the air. Four or five minutes will suffice by this process, which is not laborious, to cool the sirup. The free end of the box may then be left low enough to draw off the sirup therefrom; the cross-bars being loosely fitted to the bottom, allow the sirup remaining in the divisions to flow under to the lower end.

REFINING SIRUP.

The only known substance capable of effectually cleansing, deodorizing, and decolorizing saccharine solutions is bone coal. Charcoal possesses nearly the same property, but in a comparatively insignificant degree. Filtering with bone coal is an operation of considerable magnitude when properly carried on, and persons who contemplate engaging in the business extensively will, of course, consult the published work upon the subject. Operators in the vicinity of large cities, where fresh coal can be obtained and transported back for reburning without too great cost, may employ it, even in a small way, with advantage; not, however, as it is commonly supposed, for the purpose of making an inferior sirup good, but only for the purpose of making a good sirup better. The capacity of bone coal to fix or secrete the impurities of sirup is very limited, and, when once exhausted, it is as inert and powerless as any other substance until restored by reburning; hence when applied to sirup containing a large percentage of impurities it soon loses its virtue, but the same amount of coal applied to sirup of good quality will pass a much larger quantity, greatly improving its value. It will be understood that the action of coal is not simply that of straining or filtering in the ordinary sense; its effect is of a chemical nature, produced by the contact of the coal with the sirup. This is the theory of its action, and any plan or process that may be employed should be conformable thereto.

For a small domestic refinery a filter six or eight feet high and two or three feet in diameter is required. A false bottom two or three inches above the real bottom is arranged; this is to be perforated with numerous small auger holes and covered with two or three thicknesses of coarse sacking. Granulated coal, from which the fine dust has been sifted, is then filled in to within twelve inches of the top; upon this another course of sacking, and over all a layer of coarse sand or gravel. The filter may then be filled with hot semi-sirup, about the density of 20° Beaumé, and allowed to stand four hours, after which a small stream not more than an eighth of an inch in diameter may be run off through a faucet, entering the space between the real and false bottom. The first runnings will be discolored by fine coal dust washed down, and should be returned to the filter. After it commences running clear, supply the filter with fresh sirup and continue the flow through the faucet until as much has been passed as will make, when concentrated, one gallon of sirup for every four pounds of coal in the filter, after which follow up with hot water, and continue until the water coming off marks as low as 2° by the saccharometer, when it will no longer pay for evaporating, and the water remaining may be wasted. The coal, after being drained and removed from the filter, may be reburned in close retorts, by which it will be perfectly restored, losing, however, eight or ten per cent. in weight.

The filtered sirup should be boiled down to the consistency desired without delay. If the process of filtering is to be performed upon sirup which has been concentrated to the ordinary density, it must be reduced to about 20° Beaumé by adding hot water, after which it should be neutralized with lime if acid is indicated, raised to the boiling point, and carefully skimmed. It will be found an advantage to mix with the sirup after it has been reduced a quantity of fine bone coal, with milk, eggs, or any convenient refining agent. This will effect the removal or relieve the sirup of substances which would much sooner incumber and exhaust the coal.

With the tropical cane, where the juice is more pure than ours, the operations of defecating, refining, and concentrating are generally carried on successively; but with the northern cane a large quantity of gummy matter is expelled by boiling after the sirup has been concentrated below the density

for filtering, and by again reducing with water and boiling a second time still another separation is produced, so that the coal, when applied after concentration and dilution, has less to encounter, and will operate more effectually than if applied in the first stage of boiling. Of course the sirup has a double exposure to the fire, which it would be desirable to avoid if possible.

Bag filtering is a comparatively cheap operation, and is extensively practiced in tropical countries. It merely removes suspended matter from the sirup, without producing any of the peculiar results effected by coal. Moreover, with our northern cane sirups, until we discover a more effectual means of coagulating the albuminous substances and taking them out of solution, the bag soon becomes charged and inoperative.

An exposition of the process of sugar-making in its present condition of progress towards ultimate perfection was deemed desirable in this essay; but the expanding proportions of the features already discussed must preclude further examination of the subject. The developments of another season will furnish practical data for a much more complete and reliable discussion of crystallization, draining, and refining of sorghum sugar. Indeed, the statement founded upon present progress, promising and hopeful as it is, would be scarcely satisfactory. The subject is one of the first importance, and the sorghum interest, which already enhances the yearly product of national industry by many millions, is destined to far greater expansion and more productive results.

It is difficult to estimate the actual product of sirup in the United States. The sugar which is beginning to be made throughout all sorghum districts is not yet made in quantities sufficiently large to enter materially into the trade of the country. Data for a correct statement of the annual yield of sirup are comparatively deficient. Its production is mainly confined to the west; it is, however, becoming popular, and promises to be prominent in Delaware and Maryland. The product in 1862, as compiled from tables of production prepared from estimates of the Agricultural Department, was as follows in the ten States from which full returns were received, embracing nearly all of the sorghum-producing States:

	Gallons.	Gallons per acre.
Illinois	1,594,192	143
Indiana	1,241,665	155
Iowa	3,996,948	148
Kansas	158,964	149
Michigan	533,018	183
Minnesota	29,984	125
Ohio	6,484,800	130
Missouri	1,552,202	146
Pennsylvania	19,210	158
Wisconsin	38,516	125

The total of the above is 15,649,463 gallons, and the average product is about 146 gallons per acre. The crop of 1863, in consequence of the unusual and remarkable frosts of the early autumn, was almost a failure. That of 1864, as estimated by the Department of Agriculture, did not differ materially from that of 1862. A larger area was planted in all the States, except Michigan, Indiana, Iowa, and Kansas. The eastern States manifested a disposition to engage in the culture. The injury to the cane from various causes was greater than in 1862. Considering all the circumstances affecting the product, the report of the Department makes the result equivalent to that of 1862.

COTTON, (BY FREE LABOR.)

DY M. D. LANDON, HELENA, ARKANSAS.

THE following article is not presented as an abstract treatise on cotton-growing, but rather as a familiar history of how a thousand and forty acres of cotton were raised in Arkansas by free labor.

Slavery has long seemed the *sine qua non* of successful agriculture in the south, and well is it that the present revolution has developed the grand fact of FREE LABOR; that labor *is always commensurate* with its reward. The rich bottom lands of the Mississippi are now opening to a new civilization. The dark-skinned menial, the chained hero of the soil, is becoming an individual, and, with the hoe and axe, is hewing his way to citizenship.

DIFFICULTIES ENCOUNTERED.

SEED.

The difficulties encountered in 1864 in raising a cotton crop were numerous. Among these were the selection of a plantation in a convenient locality above overflow; the employment of former slaves; the transporting of stock and supplies from the north; the selection of seed, and the protection from guerillas.

Everything depends upon a proper selection of cotton seed. A very small proportion of cotton seeds germinate, even when properly cured and planted; only an average of one seed in four. When the seed is badly cured the planting almost invariably results in a failure, and the planter can only save himself by supplying corn in its place. Cotton seed, to be properly cured, should be selected from the second picking, before the first frost, and should be stored under cover in layers two feet thick, ventilated by air passages. Cotton seed contains chemically thirty-nine per cent. of oxygen, and heats readily whenever it is piled in heaps. Before planting (about the fifth of April in Arkansas) the seed should be dampened and rolled in sand, or, *what is better*, leached ashes. Lime and unleached ashes, though protecting the seed from the attack of insects, contain too much alkali for the oil in the seed. They should not be used either as a compost or for rolling the seed, though, for a general manure, ashes spread upon the land in the winter are exceedingly strengthening to the soil. A future chemical analysis will show the large proportion of alkaline salts which cotton seed abstracts from the soil, and which can only be replaced through cotton seed, lime, ashes, or guano.

An organic analysis of cotton seed made recently by the writer, under the auspices of the Smithsonian Institution, shows the chemical constitution of cotton seed to be thus:

Carbon	37.740
Oxygen	89.663
Nitrogen	7.753
Hydrogen	5.869
Salts, (inorganic)	8.960
	99.985

On burning cotton seed to ashes and making a chemical analysis, I found 55.2 of these ashes to consist of phosphate of lime. This leads me to conclude that *cotton seed* would make a valuable manure for wheat or Indian corn, which so soon exhausts the soil of phosphates.

PREPARING THE SOIL FOR THE SEED.

Soil on the Mississippi, in the region of Arkansas, should be ploughed about the first of March—always ploughing old land with a subsoil plough. After standing until the first of April, it should be "bedded up" in beds five feet apart. Immediately after this last ploughing, (from the 5th to the 10th of April,) the cotton seed should be planted. This is done in drills, running towards the sun, on the top of each bed. Many machines have been tried in planting cotton seed, but none have been successful. So large a proportion refuses to germinate that the only way to secure a "*stand*" is to throw the seed in drills in a continuous stream, *whitening* the ground. From one to one and a half bushels of seed are required to plant one acre of ground.

THE GROWING PLANT.

The first injury which can happen to good seed is the formation of a crust by the action of the sun and rain over the seed, which the young shoot cannot penetrate. This crust has to be broken delicately with a harrow made for the purpose. About the twentieth of April the young plants appear in continuous uneven green rows. A small steel *scrape* is now drawn by one mule by the side of the plants, leaving a straight row of shoots. The laborer now comes along with a ten-inch hoe, and cuts out intermediate shoots, leaving a "*stand*" from fifteen to eighteen inches apart. This "chopping out" should be done with care, as a bruise on the tender stalk will bring on a disease known as "*sore shin.*" The rows now stand five or six feet one way, and from fifteen to eighteen inches the other, and the regular work of making the crop commences. This consists of ploughing or scraping away the dirt from the roots, letting in the sun during wet weather, and turning the furrow back in dry weather, hoeing by hand during the two operations. The crop should be hoed out three times and ploughed out four times, and at all times must be kept free from weeds until the first of August. A new implement, the "*Shanghai*" plough, which ploughs and scrapes on both sides of the row at once, is now being used with success and economy.

THE COTTON LOUSE—(*Aphis.*)

This is the first insect which attacks the young plant, though the *cut-worm* has been known to ravage the early plant in the regions of South Carolina and Florida. The cotton-louse attacks the under part of the leaf and destroys its life, until it becomes sere and yellow. The production of this insect is increased by ploughing too much dirt upon the young roots and against the tender stalks in wet weather. The remedy is removing the dirt and exposing the roots to the sun's rays. These insects are propagated in immense numbers in warm, damp weather.

THE GRASS CATERPILLAR.

These insects came last year about the middle of August, and were by many at first thought to be the *army worm, (Noctua zylina.)* The chrysalis of this worm is of a dark color, and is hatched in the ground. The *grass caterpillar* is about an inch in length, and, though frequently found on cotton, seldom

does any damage if there are any weeds, grass, or vegetation to feed upon. This insect was the source of much amusement on my plantation last year. Reports had come up from New Orleans of the destruction of the entire cotton crop by the army worm, and when the grass caterpillar came I took it for the real army worm. Guerillas, notwithstanding my own *fort,* and the vigilance of Gen. N. B. Buford, commanding the Helena post, had captured my mules and laborers, and the crop was quite full of weeds and grass. I many times congratulated myself as I found this insect devouring the grass and weeds, and I thought it was a happy thing to save my crop, and often felt like taking off my hat and thanking the guerillas for relieving me of my last forty mules. But I was soon disappointed. I escaped the *Scylla,* but fell upon the *Charybdis.* No sooner had the grass worm finished its mission and left the rows clean, than the legitimate

COTTON CATERPILLAR, (*Noctua zylina,*)

made its appearance. This is the cotton army worm, which swept like a blast from New Orleans to Helena, devouring everything of a tender nature before it. In the parishes around New Orleans the crops of 1864 proved a total failure through its ravages.

At Vicksburg and Goodrich's Landing they were not so destructive, and at Helena a fair crop of cotton was saved. The islands of the Mississippi were safe from its ravages. The following engraving, drawn by T. Glover, of the Agricultural Department, who is the author of a valuable scientific treatise on insects frequenting the cotton plant, represents the chrysalis, caterpillar and fly of this insect:

The army worm of 1864 measured about one and one-fourth inch in length, and was of a green color, with parallel light stripes along the back. They continued to grow darker in color with each successive brood as the season advanced. The worm commenced its ravages at New Orleans as early as August first, and continued to travel northward, sweeping destruction through every cotton field on the main shores until it reached Helena, about the tenth of September. I do not understand why the islands in the river were untouched, but certain it is that on island 74, about the mouth of the Arkansas, 1,700 acres of cotton were grown without the appearance of the army worm. This worm is said to appear periodically about once in ten years in Arkansas. In 1856 many fields were ruined.

Rev. Dr. J. B. Pinney informs me that, in his travels up and down the river on a balmy evening, he saw the moth of the army worm in swarms on the boat, flitting and creeping hither and thither over the bulwarks and along the hurricane deck, attracted by the boat lights. A diversity of opinion exists as to how the species of this insect is propagated, and how it survives during the winter season. It is generally concluded that the moth deposits itself between leaves in warm locations in adjacent swamps. These moths remain folded between the leaves until the following summer, when, warmed by the sun, they fly away and deposit their eggs upon the leaves of the cotton plant. These eggs are very numerous. In warm, damp weather, propagation goes on with the greatest rapidity. The army worm subsists upon the leaf until nothing remains but the dismantled ribs. It also devours the young "squaws," drying up the sap from the young bolls, and exhausting the life from the terminal shoots. Often remaining about twenty days, destroying every green thing from the

lowest branch to the terminal shoot, the caterpillar ceases to feed, and rolling up the dismantled ribs, it forms a skeleton cocoon, and goes to rest. No means of prevention are yet discovered against this insect.

COTTON MATURING.

The cotton plant grows from eight inches to eight feet high. The bolls begin to mature and continue ripening from the first of September. It is generally agreed that all blossoms coming before the fifteenth of September will ripen and make good cotton. Three hundred and fifty pounds of lint, or twelve hundred pounds of seed-cotton, is an average yield. The process of picking cotton is very slow, requiring at least ninety days, commencing on the first of September to pick out the entire crop. A gin-house is easily constructed, requiring only room for the lint cotton as it passes out of the gin. A wall tent has answered for a gin-house very well. A good eighty-saw gin will gin eight bales of cotton in twelve hours, which is as much as seventy-five laborers can pick.

FREE VERSUS SLAVE LABOR.

Free labor, when paid in proportion to the amount of work done, has been found remarkably successful. The following impartial schedule will show the average amount of wages earned by each person during the summer. These names are taken from the list of one hundred and seventeen laborers, who received from sixteen to twenty-five dollars per month:

	Months' labor.	Received in rations.	Received in clothing.	Received in cash.	Total.	Family.
Cæsar Graves	6½	$34 00	35 50	45 00	164 00	Wife, two children.
Willis Bowlar	7	65 00	24 00	81 00	170 00	Wife.
Tom Wright	6	40 00	35 00	69 00	143 00	Single.
Joshua Bradley	7	55 00	25 00	96 00	176 00	Single.
Sylvester Hubbard	5	38 00	12 00	75 00	125 00	Wife, child.
Jack Freeman	6	39 00	57 00	54 00	149 00	Wife.
WOMEN.						
Lucinda Allson	6	37 00	36 00	25 00	98 00	One boy.
Tabitha Cobbs	6	34 00	28 00	19 00	81 00	Two children.
Mollie Fellows	6	36 00	16 00	24 00	76 00	One child.

Many of these laborers, of their own option, worked over time, and received remuneration therefor, which accounts for the amounts received.

The negroes manifest the most intense fear and dismay at the appearance of guerillas, preferring to sleep in the woods to running the risk of capture in their own cabins. This fear has kept them from the faithful discharge of duties and contracts. It is the general opinion that, with a limited amount of education, they will labor as *freedmen* as well as the freemen of the north. It is certain that the full black African will labor more studiously than the northern negro touched with Anglo-Saxon blood.

EXPENSE.

The average expense of raising one thousand acres of cotton by free labor last year was $30,000, or $30 per acre, including the payment of rent to the government or private citizen, and the purchase of new stock and implements from the north.

It is a demonstrated fact that labor is performed by freedmen to an amount commensurate with the wages paid, as well in the south as in the north. Capitalists, in opening up again the cotton lands of the south, need have no fear of the freedman as a laborer. Day by day he is vindicating himself from the calumny of slavery; day by day he is clearing his way to a grander destiny!

FLAX CULTURE.

BY MICHAEL FRYER, WILMINGTON, DELAWARE.

At the suggestion of friends interested in flax culture I propose to give a brief statement from my long experience for the guidance of American agriculturists who are unacquainted with this invaluable farm product. In so doing, my object is to arouse farmers to a sense of their duty and interest, many of whom are skeptical and wedded to their old prejudices, unwilling to experiment with anything new and useful, or to take counsel from their more practical or enterprising neighbors. The time has come, or soon will, when landholders will vie with each other in cultivating the greatest possible breadth of flax. As it is equally profitable with any root or cereal crop that land will produce, without taking into consideration the national benefit derived from its cultivation, it is to be hoped that the government will encourage flax-growing throughout the loyal States, at least until farmers come to know its value as an annual crop in the farm rotation.

SOIL.

Flax thrives in rich silicious soil, a moist strong loam or good upland on which cleaning crops were grown the previous season, such as carrots, turnips, mangel wurtzel, or corn. Flax will not thrive in close proximity to obnoxious weeds; on dirty land it will prove a failure, or will treble the expense of harvesting, which would be a great drawback on the profits of the crop. As manufacturers would not wish to buy flax mixed up with weeds, it is indispensable to have clean land. Such farmers as intend trying the experiment next spring should select a suitable patch of ground this season, and keep it clear of weeds by continual hoeing.

PLOUGHING.

All land intended for flax should be ploughed deep early in November—not flat, but ribbed, at an angle of forty-five degrees, for the purpose of having it sweetened and pulverized by the influence of the weather through the winter months. It should be cross-ploughed by the beginning or middle of April.

SEED-SOWING.

Should the weather prove favorable from the middle of April up to the 12th of May, no time should be lost in preparing the ground for the reception of the seed, by rolling and harrowing until made very fine; after which, the field or patch should again be gone over with a light wooden roller, for the purpose of seeing with the naked eye if the seed be evenly sown. The seed-sower should have an attendant, who is to put up sights at nine feet apart in straight lines, beginning on the breadth or length of the land according as the wind may favor. Two rows of poles or switches should be put up before the sower commences, and, as he progresses, the attendant must keep close in his wake, removing the first line of switches nine feet to the right, and so continue to the end. Then, with a bush-harrow, the field should be gone over, and finally rolled with a light turnip roller which a small boy could readily draw, and get over two acres in a day with. The latter process need not be resorted to if the flax is to be hand-pulled. Should good fibre be desirable, it will be necessary to sow two and a half bushels of seed to the acre; one bushel will be sufficient if a large amount of seed be desired. The seed selected for sowing should be plump, of a light brown color, and glossy in appearance.

PULLING.

About the 16th of July, probably a week earlier or later, the bolls begin to ripen and the seed turns to a brown color; the flax stems having lost their leaves, will appear yellow. The pulling or cutting, as the case may be, should at once be attended to. (I am for pulling, as it will more than pay the extra labor.) If the weather threatens rain, the flax should be tied into small sheaves, put in stacks, and hooded like wheat, lest the seed bolls should burst, and be injured by dampness. If the weather be dry and sunny, it would be much better to let the flax lie flat on the ground for a day or two in order to strengthen the fibre and ripen the seed, then tied and treated as above stated. After a few days drying it may be carted from the field, housed, or stacked, if not previously sold.

RIPPLING.

In default of better convenience, any wheelwright or carpenter could construct a good ripple at a trifling cost by inserting twenty-four pins of $\frac{5}{8}$ inch iron rod, a foot or fourteen inches long, in a hard piece of wood, $\frac{5}{8}$ inch apart, with the angles opposite to each other. The piece of wood, with the pins perpendicular, should be firmly attached to a strong four-legged form, raised three feet from the ground by iron bolts, or strong wooden pins. In commencing the work it will be required to have three smart boys, whose business would be to loosen the sheaves, put the flax in handfuls crosswise to keep it from entangling, and to tie the sheaves according as they are rippled. Two men stand on opposite sides of the ripple, take the flax prepared by the boys, holding it firm, and with both hands cast it through the iron pins, which should be a little sharpened at top, then with a smart pull the bolls fall into a box placed underneath; a second pull, by turning the wrist, finishes the handful, which is cast aside, and another taken up, and so continue until the sheaf is finished, and another commenced. The rippled flax is taken and tied by one of the boys, and thrown aside until stacked or carted to the steep pond. The bolls, as occasion requires, should be emptied on a dry barn floor, where they can afterwards be crushed by a roller. This done, it can be fanned, put into bags or barrels, and stored up where no rats or mice could have recourse to it. Lastly, much of the seed will remain in what was cast out by the first fanning. All should be gathered up, carefully rolled again, and fanned as before. The last fanned seed will not be so good

for market as the former, yet will make good jelly to feed calves with, and could be converted to many other good purposes. A readier method would be to bush the flax straw with flails, after having it well dried in the stacks, which would save the expense of rippling. The latter process would not be so good, as one-third of the seed would be lost.

STEEPING.

Immediately after finishing the rippling or bushing, the flax straw should be carted to a pond previously prepared by cleaning and damming up. Four feet deep of water will be required. It is better to steep in soft or stagnant water than to run the risk of having the flax carried away by a sudden freshet if steeped in a creek or rivulet. A man provided with a long hay-fork commences, at either end of the pond, pitching the sheaves in a straight line across and as close to each other as he can put them; the root end of the next row to reach the band or tip of the first. Proceed so until all is disposed of, taking care that none of the flax shall appear over water, it being indispensable to have it equally fermented.

In seven or eight days after being put in steep it will require constant watching, lest it should get too much fermentation, which would leave the fibre nearly worthless. Bubbles will be seen rising on the water when fully steeped. This can be easily ascertained by taking a few straws from one of the sheaves, rubbing them between the finger and thumb; the woody core will drop from the fibre; should it then break off in the middle by a slow, strong pull, it will be a sure sign of its being too long in the water. If, on the other hand, it does not separate, no time should be lost in having it raised from the pond and thrown on the bank in a slanting position, in order to let the water drain off. In an hour or two afterwards it should be carted to the spread-field—a late-mowed meadow would answer best; the flax will shade the roots of the grass from the burning rays of the sun, the effect of which will bring on a quick after-math—the sheaves dropped in straight lines by the carter; men, women, or boys to open the sheaves and spread them quite thin, leaving three or four inches between the lines. In a few days (say twelve) the fibre will begin to separate from the woody core, at which time all should be gathered up—choosing a dry day for the purpose—tied in bundles, and carted to where it will receive no damp until such time as opportunity serves to have it sent to a flax mill to be broke and scutched.

Cost of seed, labor, &c., of one acre of flax, unrotted.

COST.	
First ploughing	$1 50
Second ploughing in spring	1 00
Harrowing and rolling	1 00
2½ bushels of seed, at $3 50 per bushel	8 75
Sowing, bushing, harrowing, and rolling	2 00
Weeding	2 00
Pulling	7 00
Threshing seed and farming	5 00
Carting from field	1 00
Rent of land	6 00
	35 25

PROBABLE RETURN.	
2 tons of flax straw	$50 00
36 bushels of seed, at $3 50	81 00
	131 00
Deduct first cost	35 25
	95 75

Assuming that I give full credit for all expenses, I presume the above margin will be considered a reasonable return of profit from an acre of unrotted flax. As a further inducement to flax-growers, I beg leave to state that a greater amount of profit would be obtained from an acre of steeped and rotted flax, if treated by a practical man. Thus:

COST.		PROBABLE RETURN.	
First cost, as above	$35 25	36 stone of 14 lbs. each, say 504 lbs., sold at the present price, 60 cents per lb., would amount to	$302 40
Add steeping and spreading	4 50	Deduct first cost	48 75
Raising and tying in bundles	1 00		
Breaking and scutching	8 00		
	48 75		253 65

Should the latter margin be considered a lure in order to induce inexperienced farmers to grow flax on a large scale, let them not try it until such time as they are fully convinced of their error by the practical knowledge of their more enterprising neighbor.

VARIOUS SUGGESTIONS.

When the crop is taken off, the land may be ploughed again and sown with buckwheat or rye. It could also, at the time of sowing the flaxseed, be laid down for pasture with mixed grass seeds, such as sheep fescue, timothy, fiorin, poa trivialis, perennial rye grass, and white hay seed. The leaves which fall from the flax stems, together with the clay stirred up by the pulling, will answer as a top dressing. By the latter end of August or beginning of September it will afford a good bite to sheep or cattle. These remarks look well on paper, yet they are not the less true. But flax-growing in this vast country has its drawbacks at the present time, but it is to be hoped this evil will soon be remedied. Firstly, a farmer lives thirty miles or upwards from where he could bring his flax to market; what is he to do in the event of his growing such a crop? Where is he to get it broke or scutched? Should he contract with a man coming along with his machine, who works for him, he must submit to his exorbitant charge, which perchance would take away half the profit of his crop. This is not all. Although his flax has got into small bulk by scutching, even if he has to send a great distance to market, he is still at the mercy of the buyer, who probably would tell him it got too much rotting, find some other fault, and finally say it would not suit him. The farmer gets bewildered, thinks of the long journey to his home, calculates his expenses, offers his flax at a reduced price sooner than bring it back, and, lastly, will sicken of flax-growing. As a cure for such sickness, let flax mills be erected, (one in every county would be sufficient,) and markets established at convenient places where farmers could have easy access. Buyers could select the flax which would suit them best, whether flax-cotton or long heckled stricks. Such mills as I speak of could be got up for about five hundred dollars alongside of any constant stream of water. They would pay the first cost in two years by renting them, and be a national benefit for years afterwards. Private individuals could not invest their money better than in the building of scutch mills; the government has its own business to attend to. Farmers and all others interested in agricultural pursuits should also attend to their business, independent of government's aid or advice. It is high time Americans should look to their own interest and grow their own flax, which may afford as much employment to the working class as cotton has done heretofore. The money paid for Irish linen would be kept in the country. As good flax can be grown in the United States of America as is grown in the old country. There are as good artisans, water-power, and machinery here as in Ireland or England. With all these advantages, it may naturally be asked, why not put a stop to this enormous drain of money which finds its way annually into the pockets of the Belfast Flax Society from this country in return for their dear-sold linen fabrics? John Bull has pushed his trade into America for the last half century, bought southern cotton cheap, sent it back to the northern States wrought into fabrics, where he got a good and ready market, thereby enabling him to support 4,000,000 of his

paupers for many years past, who are at the present time bordering on rebellion for want of cotton to keep them employed. An unlucky shot that, which reverberated across the wide Atlantic and paralyzed the cotton lords of England and their subordinates for the last four years.

What I have stated in the foregoing treatise is neither filched nor borrowed from the various and conflicting reports of other writers on the cultivation of flax, as heretofore published. What I have written on the subject is solely taken from my own experience of twenty-seven years in the best flax-growing country in the world—Ireland.

I beg leave to offer further practical suggestions as an inducement to such farmers as would wish to know if flax would be a paying crop preparatory to trying the experiment. I have already stated that no cereal crop would pay so well, proving this assertion. I am now fully convinced that two crops can be raised from the same land and brought to full perfection within five months; that is to say, from the eighth of May to the first of October. And it is more than probable the last crop may turn out the best, inasmuch as that the season of its mortal enemy will be past and gone before it is sown, and by adding the value of the latter to that of the former crop would, in my opinion, have a satisfactory margin to any man short of a *miser*. What I have here stated may be called theory. It is no such thing; it is sound practical information.

I finished my flax-sowing on the 11th of May last, and had it harvested on the 12th of July; by the 18th had the seed bushed out and sent to Philadelphia, sold it at three dollars and sixty-five cents per bushel, which amounted to seventy-three dollars, including three bushels I kept for seed. The straw I afterwards sold to Mr. Pusey, of Wilmington, for twenty-eight dollars and fifty cents. The cost of seed, rent, and labor, twenty-six dollars, deducted, left a balance of seventy-five dollars and fifty cents in my favor for the produce of one acre fifteen poles. Considering the short period of time it took to ripen the first crop, I concluded there was season enough to grow a second. Accordingly I prepared a small patch of the ground on which the first crop had been grown, sowed it with the same seed without using guano or phosphate, which might be necessary to give it a start. The latter crop ripened the seed and was fit to pull by the 2d of October. Apart from these, some seed dropped from the bolls when removing one of the stacks of the first crop on the 18th of July; it germinated and has grown two feet long. The only difference I can discover between what was covered with a rake and what had shed its seed on the dry ground is, that the former ripened its seed, whilst the latter produced little or no seed. My object in making mention of this latter self-producing flax in this report is to show that flax is not a tender plant; it is a rapid grower, requiring very little trouble or care to bring it to perfection. Had the land on which the first crop was grown been ploughed immediately after clearing off the crop, and prepared in the usual way, giving a top dressing of phosphates or guano, I have no doubt on my mind but there could be as good flax fibre produced from the late sowing as from the earlier, but not so good seed.

Should this be the case—I have the proofs by me—I hope and trust that farmers will turn their thoughts to flax-growing next season extensively; it will benefit themselves to do so. Of this they will be fully convinced when balancing their accounts after disposing of the crop.

In order to be certain what effect frost would have on late-sown flax, I left the greater part of what I sowed on the 18th of July on the ground as it stood until the 11th of January. On the 14th I brought these samples to Mr. Pusey, for the purpose of having it run through his machine, in order to test its quality previous to my sending the samples to the Agricultural Department. No. 1 sample, pulled October 2, pronounced by Mr. Pusey as being the best, and equally as good as the greater part of the first I sold him. No. 2

rather damp to run well through the machine; it flattened and retained much of the woody core, yet is strong, sound fibre; this sample was pulled about the 1st of November. No. 3, pulled January 11, spoiled by the frost, is only good tow or fit to make paper of. Mr. Pusey says if I had pulled the latter sample at the proper time, and dew-rotted it up to this time, it would be as good as either sample. I care nothing about the loss. I gained the information sought by trying the experiment.

It has been a matter of doubt, and a subject of great inquiry for some time past, whether or not flax fibre could by any mechanical process be converted into flax-cotton as a substitute for cotton, in order to meet the necessity of the manufacturers, who can at the present time obtain but a scanty supply of the staple from the southern States. On this subject further doubt is uncalled for. If no more improvement can be made in machinery than what is at present in working order, as much flax-cotton can be prepared as would keep all spindles in the States in operation. If improvement can be made in machinery, all the better.

There are at this writing immense piles of flax-cotton in Messrs. Pusey's mills, at Wilmington, Delaware, going through the different processes required previous to spinning. Some I have seen converted into yarn of superior quality, spooled. Some more I have seen ready for spinning, which he bleached by a chemical process in a short period of time. Several tons of flax-straw stand up ready for breaking; his machine for the purpose is the best I have seen, attended by a buffer and three boys only, and if he only had enough of flax to keep it working the year round he would need no more cotton.

A small insect, commonly called the flax flea, often attacks the flax plant in the beginning of May, whilst in the lobe leaves, and, if not guarded against, would in a short time destroy a whole crop. The best way to make this pest decamp is to dust the young braird early in the morning whilst the dew is on. Any dry clay beaten fine will do; ashes or powdered lime, if convenient, will be much better. It will be useless to dust the flax plants after sunrise, as the dust would be blown off by the wind. What would be done early in the morning would hold on the leaves if not washed off by rain. This simple remedy is applicable to turnips, squashes, cucumbers, or potatoes.

THE HOP PLANT.

BY LEWIS BOLLMAN, OF THE DEPARTMENT OF AGRICULTURE.

THE cultivation of the hop has rapidly advanced in the United States. The use of malt liquor has increased, not only on account of the large access of German population, but because of the growing taste for it among Americans. The high taxes on alcoholic liquors will induce a greater use of malt liquors. There will, therefore, be an increasing demand for hops.

The entire crop of this product in the United States has been as follows: In 1840, 1,238,502 pounds; 1850, 3,497,029 pounds; 1860, 11,010,012 pounds; and, as estimated, in 1862, 16,000,000 pounds.

But it is the most uncertain of all crops raised in this country. That the extent of this may be seen, and its influence on prices determined, I will refer to this uncertainty as it exists both in the United States and Europe.

Mr. Rouse, of Oneida county, New York, alluding to the causes and extent of this uncertainty, says:

"Very much will depend on the season. This year, (1856,) for instance, has proved to be very unfavorable, the yield being only about one-third of a full crop. One hop-grower of my acquaintance has obtained but 12,000 pounds from grounds which last year produced 32,000; and another has only 4,000, where last year he obtained 16,000. The universal complaint is that the crop has been very light. Taking one season with another, the range of different fields is from 400 to 2,000 pounds to the acre. Instances have, indeed, occurred occasionally in which the latter quantity has been exceeded, and in one instance an average of near 2,800 pounds was obtained. One thousand pounds per acre may be considered a fair crop; but the general average would, no doubt, fall below that, and would probably be about one pound per hill, or 888 pounds to an acre."

Mr. W. P. Riddle, a dealer in, an inspector, and a grower of hops for forty years, prepared a table showing the amount raised and the prices per pound in New England from 1806 to 1853, inclusive. This table exhibits the irregularity of the amount produced in a most striking manner. The most irregular period is from 1832 to 1839, and is as follows:

Years.	Pounds.
1832	606,602
1833	1,136,134
1834	1,174,599
1835	963,238
1836	1,441,936
1837	940,857
1838	663,766
1839	452,225

As regular a yield in a series of years as any given is the following:

1849	707,856
1850	528,685
1851	537,668
1852	839,723
1853	640,076

A like uncertainty of the crop exists in Great Britain, one of the best countries for hop-growing. The following table shows the number of acres in hops in the years named, and the pounds produced. Those years only are given which exhibit the greatest extremes, but even where the annual production is more regular it is nevertheless very irregular:

Year.	Acres.	Yield per acre.	Year.	Acres.	Yield per acre.
		Pounds.			*Pounds.*
1807	38,218	586	1823	41,458	124
1808	38,436	1,465	1824	43,419	795
1809	38,357	360	1825	46,718	120
1810	38,265	368	1826	50,471	1,237
1811	38,401	927	1839	52,305	911
1812	38,700	141	1840	44,058	127
1822	43,776	1,037	1841	45,769	697

From 1841 to 1850 the yield was more regular, being about 896 pounds per acre.

Such irregular production is necessarily attended with a corresponding difference in prices. In the first series of years as above given from the table of Mr. Riddle—that is, from 1832 to 1839—the price per pound varied from 23½ cents to 6 cents; and in the second series, from 1849 to 1853, from 7 cents to 30

cents. The following table will serve to show the general and more recent variation in prices :

Years.	Prices.	Years.	Prices.	Years.	Prices.
1850	22 to 60 cents.	1855	4 to 10 cents.	1860	6 to 32 cents.
1851	17 to 47 cents.	1856	4 to 12 cents.	1861	13 to 23 cents.
1852	17 to 40 cents.	1857	4 to 10 cents.	1862	....
1853	22 to 46 cents.	1858	8 to 18 cents.	1863	15 to 30 cents.
1854	5 to 36 cents.	1859	6 to 25 cents.	1864	20 to 52 cents.

These are the New York prices, as given in the Finance Report of the Treasury Department for 1863. They show more the differences in price of different months than of the different qualities of the hop.

An annual product so irregular, with a consumption generally very regular, must occasion an irregular foreign demand, arising from those countries, like Great Britain, where the consumption of hops is always greater than its production of them. This will be seen in both the following tables, the first showing the imports of hops by Great Britain for a series of years, and the last our exports for the same years :

Import of hops by Great Britain.

Years.	Pounds.	Years.	Pounds.	Years.	Pounds.
1850	725,648	1855	2,762,144	1860	7,718,816
1851	51,744	1856	1,790,544	1861	16,707,712
1852	34,608	1857	2,095,632	1862	14,984,592
1853	4,742,528	1858	1,456,000	1863	16,495,472
1854	13,330,480	1859	248,640	1864*	7,628,768

* For ten months only.

Exports of hops by the United States.

Years.	Pounds.	Years.	Pounds.	Years.	Pounds.
1850	1,275,455	1855	4,021,816	1860	273,257
1851	110,360	1856	1,048,515	1861	8,835,837
1852	238,008	1857	924,538	1862*	....
1853	245,647	1858	458,889	1863*	4,415,400
1854	260,026	1859	587,953	1864*	5,081,800

* Estimated at 200 pounds per bale, the returns being in bales.

The hop is used in brewing for preserving and giving flavor to malt liquors. That part of it which is most valuable is the yellow substance that envelopes the seed. It is sticky or glutinous, of a very bitter taste, and has a peculiar, agreeable, and aromatic odor. But this aroma is extremely volatile, so that, with the greatest care in packing the hop closely in bales, it so rapidly escapes that after the hops become a year old their value rapidly deteriorates. How far the use of strong hemp-cloth, gummed with India-rubber, would prevent this escape of the aroma, or would be profitable, is yet to be determined by experiment. But a product so constantly in demand, yet so uncertain in its

yield, and which can be kept for a short time, must necessarily give rise to speculative purchases. Hence another element creating fluctuating prices. Such uncertainty of production and demand fully account for this extreme range of prices. They show that the hop-grower must expect encouraging and discouraging markets, and that by superior cultivation alone he can expect to counteract, to some extent, this annual uncertainty of the product, and avail himself of those high prices which an unusual foreign demand creates.

To *point out the leading casualties which affect this crop, and the best means of avoiding them, is the chief purpose of this article.*

Thaer, in his Principles of Agriculture, thus speaks of these numerous casualties:

> "In fact, the success of the hop is mainly dependent on the weather and the absence of certain accidents to which the plant is exposed. The care bestowed on the formation and culture of the hop-ground may, indeed, obviate casualties to a certain extent, but cannot utterly remove them. A warm summer, with moderate winds from the south and southwest, and not much rain, is favorable to the hop; but in wet seasons, particularly when the wind blows much in the summer from the east and north, the hop is sure to fail. When a hot sun follows a rain or fog or sultry days, alternate with cold nights, the hop suffers considerably, even when these occurrences take place only at the latter end of the summer. In spring the hop suffers from the attacks of an insect of the flea kind; in summer, from various kinds of flies and lice; in the last stage of its growth it is exposed to mould, especially when the hop ground is in a low and confined situation. In the midst of all the dangers and enemies with which the hop is surrounded, its success is, in a great measure, a matter of chance."

But, despite of the discouragements which this eminent German authority points out, (greater in Germany than here,) yet *the general profit* of this crop is thus correctly spoken of by an excellent English cultivator of it, Mr. Manwaring. He says: "He who is diligent, however, and understands his business, is well paid for his trouble and expense; for two or three acres of well-managed hop-ground, *one year with another,* amount to more advantage than fifty acres of arable land, with equal or more expense." This will be seen from the following estimates: In Great Britain the average yield is probably about 750 pounds per acre. Mr. Rouse places it in this country at 888 pounds. He estimates the entire cost of production at about 10 cents a pound, including the picking. From 1806 to 1864, inclusive, a period of fifty-eight years, the average price of hops in New England has been 14¾ cents per pound. In these years it was at one time as low as 1½ cent per pound—in 1812. But when prices were low the cost of production was not so high as now. Its estimated cost then was 5 cents per pound. Placing the average cost of production during these years at 7½ cents per pound, and the average yield, as given by Mr. Rouse, at 888 pounds per acre, the net profit would be 7¼ cents per pound, or $64 38 per acre.

Having, in this general manner, referred to the nature of the hop crop, to the care necessary to its protection from enemies and diseases, and the profit which may be expected under proper cultivation, I proceed to consider *the enemies and diseases most injurious to the plant in the United States; the soil and manures best adapted to its growth; the location of the hop grounds, and their management; the cultivation of the plant; the picking, drying, and packing of the hops.*

ENEMIES AND DISEASES.

We have seen how uncertain the hop crop is. This is chiefly owing to its enemies and diseases. In England these are numerous; but here it will be necessary to notice but one of each—the *aphis,* or *louse,* and the *mould.* They will be noticed at some length, however.

1. *The aphis.*—The correspondents of this department, in speaking of the injuries received by the hop crop of 1864, describe these insects, so common to

many plants, and speak of them as *lice.* The following description of them is given by Mr. Harris:

"The winged plant-lice provide for a succession of their race by stocking the plants with eggs in the autumn. These are hatched in the spring, and the young lice immediately begin to pump up the sap from the tender leaves and shoots, increase rapidly in size, and in a short time come to maturity. In this state it is found that the brood, without a single exception, consists wholly of *females*, which are wingless, but are in a condition immediately to continue their kind. Their young, however, are not hatched from eggs, but are produced alive, and each female may be the mother of *fifteen* or *twenty* young lice in the course of a single day. The plant-lice of this second generation are also wingless females, which grow up and have their young in due time; and thus brood after brood is produced, even to the seventh generation or more, without the appearance or intermixture, throughout the whole season, of a single male. This extraordinary propagation ends in the autumn with a birth of a brood of males, which in due time acquire wings, and pair; eggs are then laid by the females, and with the death of these winged individuals, which soon follows, the race becomes extinct for the season."

The eggs are not destroyed by cold or wet; and drought is favorable for the multiplication of those lice born in the summer, and wet unfavorable. Hence their rapid increase in droughts. The effect of the attack of these lice on the hop-vines is thus described in Morton's Cyclopædia of Agriculture:

"When the first attack of these upon the hops is severe, and early in the season, the growth of the plant is commonly stopped in the course of three or four weeks. If the attack be late—that is, about midsummer, or afterward—the bine has then attained so much strength that it struggles on against the blight to its disadvantage, and the result is a total failure of the crop at last; for the leaves fall off, and the fruit-branches being already formed, there is no chance of recovery. At this time and in this condition the stench from the hop plantation is most offensive. In an early blight, however, we have many instances recorded of extraordinary recoveries; for these insects are remarkably susceptible of atmospherical and electrical changes, and on a sudden alteration of the weather we have known them perish by myriads in a night. The condition of a plant is never hopeless, however severe the attack may be, provided there is *time* for it to put forth its lateral or fructifying branches."

The progress and termination of the attack by the lice, when severe, is thus described in the same work:

"Their multiplication is so rapid that the leaves become so thickly covered as scarcely to allow a pin to be thrust between them. They quickly abstract the juices of the bine, so that the leaves assume a sickly brown hue, and curl up, and the bine itself ceases to grow, and falls from the pole, the lice continuing till they perish for want of food; and thus, without the intervention of a favorable change, the crop is destroyed, and the grower may often consider himself fortunate if the plant recover a due amount of vitality to produce a crop in the following year.

"When atmospherical change occurs, the lice die off by thousands in a day. As they die they turn a brown color. The first indication of a favorable change is the clustering of the lice to the extremities of the bines and branches. This fact is well worthy of notice, since, to all but close and accurate observers of the hop plant, the outward appearance is the reverse of a favorable change; for the small leaves and heads of the bines are densely covered with lice. But while the lice are thus gathering in countless myriads at the extremities, apparently threatening the utter destruction of the plant, the large leaves at the bottom of the bine and the leaves of the branches next the stem are becoming clean. At this *clustering* period the lice evidently cease to suck the juices of the plant; for the attentive observer will perceive the bine resuming its erect position, and recommencing its upward growth, though still covered with lice. At this crisis they usually disappear altogether in the course of a week or ten days, *and then the plants should be liberally rewarded, if not lavishly stimulated with manure, there being no danger of over-manuring under such circumstances.*

"The best manure to be employed in these cases is guano. at the rate of 450 to 900 pounds per acre. The ground should be continually stirred, but this stimulus should not be given until it is certain the lice are disappearing."

Injurious insects are much lessened in number by natural enemies. That which is most destructive of these lice is the lady-bug, or, as called in England, the lady-bird. Of these the work just quoted from says:

"They, in the first instance, destroy multitudes of lice, a single one killing eight or ten in as many minutes; and where the lice are not too numerous, the lady-birds will clean the hop plantations. But, generally, the lice have time to deposit some of their young on the under side of the leaves before their enemies attack them, especially if the weather be

clouded, when the lady-birds are sluggish and inactive. The lice are seldom devoured at this time, but the lady-birds lay their eggs also on the under side of the leaves, usually in clusters of about twenty each. These eggs adhere to the leaves, are yellow in color, and of a long, oval shape; they are soon hatched, and the progeny which creeps forth is the "black nigger" or "serpent," as they are called in the districts. They are ferocious-looking creatures, greatly resembling in shape, though not in size, the lizards of the olden time. As soon as they are hatched they commence the work of destruction upon the lice, which are their peculiar food, as the lice are of their parents, the lady-birds; and if the lice are not extremely numerous, they often succeed in clearing the plant of the vermin; otherwise they devour them until they are literally gorged with food, and then, attaching themselves to the leaves of the hop, after remaining dormant in the larva state, they cast off their outer cuticle, and are transformed into the perfect lady-birds, when they again pursue their good work of destroying the enemies of the hop—consuming about thirty lice daily."

We have described the depredations of the lice, and the good work of the lady-bugs, at some length, that the hop-grower might see the necessity of two things—*first*, having the ground in the highest condition as to richness and tillage, that the plant may be enabled to overcome the attack of the lice; and, *second*, that he might see the necessity of preserving the lady-bug, one of the most useful of the beneficial insects. The lice could be destroyed by syringing the vines with whale-oil soap-suds, but this remedy is too tedious for hop cultivation.

2. *The mould.*—There are various diseases to which common parlance has given this name, but the one now described is the most fatal to the hop. These diseases, like the lice, are parasitic—that is, both exist upon the juices of the hop plant, which, being deprived of them, are blighted. Hence the term *blight* does not designate the *cause*, but the *result* of the attack of the disease or insect. Morton's Cyclopædia of Agriculture thus speaks of the disease now under consideration:

"The mould is a disease rather than a blight. We believe it to be a parasitical vegetable fungus, usually generated in wet seasons and in damp situations. It is of all diseases the most dreaded by the hop-grower, inasmuch as there is no known remedy for it, and as it steadily progresses in its attack, with more or less rapidity, according to the character of the season, till the crop is gathered. It often originates from the negligence and inattention of the cultivator, and thus prevention is better than cure. It is intimately allied to, if it be not precisely the same as, the white mildew which we see in hawthorn hedges, and on rose-bushes, especially if the latter grow in shady situations. When the mould appears to any considerable extent upon the hops so early as the end of June or beginning of July, however luxuriant the vine may then appear, there is no hope of a crop worth picking. Dampness and a want of a free circulation of air and light seem to be the predisposing cause of mould, and thus we often see it emanate from wild hops, which are carelessly allowed to grow in neighboring hedges. As soon as this violent disease appears, it spreads in every direction with astonishing rapidity, diminishing in intensity as the distance increases from the centre of mischief. It is first noticeable upon the upper side of the leaf as a white speck, not larger than a small pin's head, the spot increasing in size till it attains the diameter of about one-eighth of an inch; below this white spot, on the *under* side of the leaf, there is a corresponding indentation, which renders this incipient indication of mould unmistakable. From the spots on the surface of the leaf the seeds of this parasitical fungus, as we imagine it to be, are blown in all directions, and the minutest particle of this white dust when it settles on another leaf in a few days becomes a minute speck of mould. Each new spot then propagates the disease, and thus we perceive this vegetable pestilence advances with fearful rapidity of geometrical progression, and if the season be damp, acre after acre falls a victim to the attack, which often originates from sheer inattention."

Mould spreads fastest in warm, damp weather. It commences near the ground, and therefore great attention ought to be paid to the frequent pulling off of the suckers, as they sprout through the hill in the summer months. Every spotted leaf should be destroyed. And here we now see the necessity of making such selection of the site of the hop plantation as will secure a free access of air and sunlight, for dryness is a check to this disease.

SOIL AND MANURE.

The soil and manure best adapted to the growth of the hop may be determined by analysis, and the general character of the growth of the plant. The roots of the hop penetrate deeply and widely, and are liable to suffer from

drought. In a climate of extremes, like ours, this drought must be guarded against, and this can best be done by having a large portion of vegetable matter in the soil, which is a non-conductor of heat, and attracts and retains moisture. It should be broken up deeply, and always kept thoroughly pulverized. It should be deep, that the lower roots may sustain the moisture of the plant in drought; and it should be well pulverized, for in such a condition of the soil air cannot dry it deeply, because it does not crack and admit large amounts of heat, and the subsoil moisture rises higher between fine particles of loose soil. This plant is a great exhauster, both by reason of the thorough summer cultivation demanded, and by what it abstracts from the soil. Analysis shows this; and the following is an English analysis of the hop:

	ANALYSIS OF THE HOP.			OF WHEAT AND WHEAT STRAW.	
	Hops.	Leaves.	Bine.	Wheat.	Straw.
Percentage of ash calculated on dry substance	9.00	21.94	7.28	....	....
Composition of the ashes.					
Silica	19.16	22.35	9.99	1.27	65.38
Chloride of sodium	0.74	3.12	2.63	....	....
Chloride of potassium	8.96	2.29	15.35	....	....
Soda	....	....	....	9.05	0.16
Potash	31.70	13.13	17.60	23.72	13.44
Lime	9.59	30.78	23.91	2.81	6.70
Magnesia	4.80	4.84	3.77	13.03	3.82
Peroxide of iron	0.68	0.19	0.80	....	....
Sulphuric acid	5.10	1.89	2.33	0.24	5.82
Phosphoric acid	17.33	9.33	11.69	49.81	3.07
Carbonic acid	1.92	12.04	11.92	....	....
Total	99.98	99.96	99.99	....	....

In this table the analysis of wheat is given also as a comparison, because it is conceded that good wheat lands may be made good hop lands. Silica in larger quantities is taken from the soil by the hop when the straw of both crops is returned to it. Both have nearly the same amount of potash and soda; but the hop has much more lime and sulphuric acid, and much less magnesia and phosphoric acid. The aggregate pounds per acre do not differ materially in these crops, estimating the number of pounds of hops at 900 per acre, and of wheat at 15 bushels, equal to 900 pounds.

The chief difference is in silica, lime, and sulphuric acid. Hence it follows that gypsum, or plaster of Paris, would be a beneficial manure for hop grounds, because it is sulphate of lime. It is composed of lime 32.56, sulphuric acid 46.51, water 20.93. Its best mode of application would be on clover after it has commenced its spring growth, for in this way it would add much to the vegetable matter of the soil, as well as to its lime and sulphur. The crop of clover should, of course be turned under.

The English regard lime as of much importance, and Mr. Manwaring recommends a mixture of barn-yard manure, muck, and "a good quantity of lime." If the soil requires manuring and deepening, this should first be done by the gypsum-dressed clover turned under to the depth of ten inches. When broken up to plant the hop roots, it should be subsoiled an additional depth of eight inches. Trenching with the spade is a useless waste of labor where the plough can be used, and hops should not be planted where it cannot; for, as the hop

demands a loose, deep soil, it would soon, except in certain localities, be washed away on hill-sides.

Barn-yard manure should always be applied during the cultivation of the crop, and even before, if the soil is not rich. In Great Britain alluvial soils are regarded as excellent; and clay soils, especially, if tenacious, should be thoroughly drained, for a plant so deeply rooted as the hop should not have its lower roots imbedded in standing water.

The character of the soil best suited to the hop may be inferred from what is said of it as found best in Great Britain: "The hop," says Mr. Manwaring, "delights in the richest lands; a deep mould and light; if mixed with sand, the better; a black garden mould being excellent for it. Hops cannot be cultivated to advantage, except on strong rich land of considerable depth of soil, which must be constantly manured, or otherwise little benefit is to be expected." The climate of England is a moist one in comparison with that of the United States, and not subject to our extremes of heat and drought. Our soils, then, should be deeper, with less of barn-yard manure, and more of vegetable matter, which has a twofold action. Vegetable matter acts not only as a manure, but also as a non-conductor of heat, and shields the subsoil moisture from evaporation by our hot burning suns.

THE LOCATION AND MANAGEMENT OF THE HOP GROUNDS.

In speaking of *mould*, the necessity of having the grounds well exposed to drying and airy winds was shown. It should also be exposed to the sun. Hence, low, damp situations should be avoided. If the ground is inclined to be heavy, as our clays generally are, especially if it is a yellowish clay, and not a red, then the grounds should be well drained. The red clays are usually drier, having less alumina and more small gravel. If the grounds lie towards the bottom of a slope, it would be well to guard them by a deep ditch, so that neither the heavy rains on the slope, nor its drainings under the top soil, could be carried into the hop grounds. The situation should also be free from heavy winds, and especially guarded against those strong-blowing winds which attend the storms of hot weather. They mostly blow from the west, and hence a southeastern slope, with corresponding high lands, should be selected. But no protection of this kind must be regarded, at the expense of thorough ventilation of the grounds.

The general management of the hop-grounds should have in view the sustaining of their fertility. The table of the analysis of the leaves and bines shows the large amount of silica, chloride of potassium, potash, lime, phosphoric and carbonic acids in them. These, then, should be returned to the soil, and this can most advantageously be done by ploughing them under. This ploughing in should be done in the fall, with some composts added. And these composts should be varied from year to year. "In practice," says Mr. Morton, in his Cyclopædia of Agriculture, "the best informed hop-growers have found it desirable to obtain a mixture of manures in the soil, which is most readily accomplished by varying the form of manuring every year." Our own experience corroborates this view, and we would recommend its continuance till more accurate knowledge on the subject is attained; for by this practice the deficient ingredients of one year's dressing will probably be compensated by the superabundance of the next.

Belonging to the general management of the grounds is the question of removing the earth immediately around the roots of the vines, and substituting other soils. In Great Britain, under proper cultivation, the hop will produce good crops for twenty years. "No rule," says Mr. Morton, "can be given for the length of time during which hops can be successfully grown upon the same soil. This must be ascertained by actual experience; but we may state, gener-

ally, that hops grow best on a *new* soil, all other circumstances being equal, &c. Ordinary land should be changed once in ten or twenty years. The durability of the hop plant is very great, when growing upon congenial soil, with careful cultivation. It is difficult to ascertain the age of particular plantations; we have one, however, in our possession, which has not been replanted for at least 150 years, and it is as flourishing as ever." He also mentions one that had been in uninterrupted cultivation for fully 300 years.

These statements show the longevity of the hop plant. How far plants leave in the soil an excrementitious matter unfavorable to their own growth, is a question not at all settled, but many facts indicate that some of them do to a great extent. That the health and vigor of the hop plant would be increased by an occasional change of the soil in immediate contact with its roots, is certain, from the high cultivation it demands, and the active and powerful manures it needs to overcome the attacks of its enemies and diseases. Portions of this soil might, then, be advantageously changed, and this could be done by running as deep a furrow with the plough, and as near to the roots as possible, and hauling rich soils or composts to fill it up, or taking the soil from the middle of the alleys and shovelling it into these furrows, thus rotating, as it were, the soil from the hills to the middle of the alleys.

CULTIVATION OF THE HOP PLANT.

Supposing the ground to have been properly prepared for setting out the plants, and that they have been grown one season from the slip, the first step is to determine the number of plants to the acre. The width of the hills, in Great Britain, varies according to the varieties of the hop—the stronger growing ones requiring more room. From six to eight feet square is the customary distances, and in the United States seven feet is the usual distance. The following table shows the number of plants required for the distances named:

6 feet	1,236	plants.
6 feet 6 inches	1,060	"
7 feet	888	"
7 feet 6 inches	795	"
8 feet	695	"

By having a white rag or other conspicuous object on the chain or measuring cord at the distances desired to form the hills, the places to set the stakes will be more readily indicated. These stakes should be of sufficient height to correct the range by.

Male and female plants.—The sexes of the hop plant are not united in the same plant, but some are male and others female. Since the sexual relation of the strawberry plants has been so thoroughly discussed in the United States, the importance of having some male plants in the hop grounds will be generally admitted. The male flower grows in a loose panicle, whilst the female flower is compact, like the cone of the pine tree. Hop seeds produce plants, but as they are like fruit seeds, producing varieties of quite different qualities, the hop plants should be multiplied by slips from a well-known and approved variety.

Although most of American farmers have some knowledge of the importance of having enough male among the female plants to fertilize them, yet this importance is so peculiar in the hop that some special reference to it is necessary.

At the base of each scale or leaf of the female blossom of the hop there is a flower, in which is the germ of the seed. As this seed matures the scales grow larger, and are covered with resinous aromatic balls, called *lupuline.* These are the fine yellow powder of the hop, and contain that bitter principle which renders the hop so valuable in preserving and flavoring malt liquors. This bitter principle is stronger or more delicately flavored in some varieties of the hop than

in others, and in proportion as the seed is fully developed. This female blossom is vitalized by the pollen of the male plant. "Though the pollen," says an English writer, "from its extreme lightness, can be wafted to a considerable distance, and some seeds in each cone may be so fertilized, yet it would be well to rear a number of the male plants among the others, or along the hedges of the hop gardens, to insure the fertilization of all the seeds. A bushel of hops collected from plants of the fourth year, raised from seed, weighed 36 pounds, there being male plants near; a second instance, where the plants were raised from cuttings, weighed 35 pounds; while a bushel, grown in a garden where the male plants were always eradicated, weighed only 22 pounds. Besides the greater quantity of hops thus obtained, the aroma is much greater (the *lupuline*, on which the aroma depends, is considered by Blanché to be the unappropriated pollen dust which has alighted on the scales of the females) and the strength of the bitter much greater."

On this point Mr. Rouse says:

"It is necessary that a small number of the male plants should be interspersed among the others, in order to give that energy and vitality to the seed which is essential to the perfection of the crop. If due care is taken in this particular, a seed will be found at the bottom of each petal of the blossom possessed of a most pungent aromatic flavor. Attention to this particular is, indeed, necessary to insure flavor and character to the product of the plant, giving it that fine aromatic bitter which is most desirable, and which it will not otherwise be possessed of, the petal or leaf of the blossom containing comparatively but little of the astringent quality of the hop. This consideration is one which I apprehend is too frequently overlooked by the inexperienced cultivator, who sometimes rejects the male plants as barren, to the great injury of his crop."

He recommends one male plant to fifty female.

In selecting the varieties of the hop to plant, two things are regarded in Great Britain—the flavor and the time of maturing. The strong growers are usually the largest bearers, but have not that delicacy of aroma that is found in smaller and less prolific varieties. In large plantations, where the picking season should be long, such varieties are selected as will give different times of maturity.

Mr. Manwaring says:

"I would advise planters to be particular in the sort of sets they intend to use. It is advisable to have different sorts, as in an unfavorable year some kinds are more hardy, and can stand the severity of the weather better than others. There is also another advantage: in a plantation of twenty or thirty acres and upwards (in the United States, because of the scarcity of labor, a much less number) it is advisable to have about four or five acres planted with an early sort, such as Jones's, Mathon's, or Cooper's Whites, which as soon as quite ripe should be gathered in, if within five or six days the better. Then Goldman's and the Grapes, which is a later description of hop. The Cholegate are a smaller and late hop, but fetch a good price in the market. The sets I would recommend are the Kent Cholegates, Canterbury Goldings, Jones's, Mayfield Grapes, Mathon and Cooper's Whites."

Planting.—In preparing to plant, it is best to bed in the spring the necessary sets, for by the fall they will have attained a year's growth, and whether they are set out in the fall, or in the following spring, it will be so much time gained. Then they are more certain to grow, will require a less number in the hill, and give much less trouble during the first year's growth after being planted.

In Great Britain it is usual to plant in raised hills. But there the climate is moist; here the extreme droughts dry them too much. Hence, *level* cultivation, generally, has superseded hill cultivation, and the hop plant should not be an exception. In setting the plants, manure should not be put in the hill, especially new, unfermented barn-yard manure, but a richer soil might be added, if the ground is not in sufficient condition. The roots of the sets should be spread out carefully; good, fine mould put around them, the soil pressed firmly, and the earth heaped over them.

The number and length of the poles.—Each hill should have two poles. In England, the number is determined by the kind of hop. The Farnham Canter-

bury white bines and the Goldings are strong growers, and require large poles—from 14 to 20 feet long. The Grape varieties are smaller, and need poles not exceeding 10 to 14 feet in length. The Cyclopædia of Agriculture, as to the number of poles in Great Britain to the hill, says: "When there are about 1,200 hills on an acre, and the poles all 18 feet long and upwards, we should recommend *two* to each hill, with 16 feet poles, every *third* hill to have three; with 14 feet, alternately *two* and *three* poles; with 12 feet poles, *three* to each hill." But in this country, where ground is not so valuable as in England, a lesser number should be used, that more air and sunlight may be allowed, to lessen the evil of mould, and give greater vigor to the plant when held back by the aphis.

The poles should be sharpened with a regular taper, and holes for them made by a heavy crowbar; and when two are in a hill they should be about a foot apart, the tops inclining somewhat apart, to give more room to each top, and prevent the branches from intertwining. The strongest poles should be selected for the outside, especially for that part of the plantation most exposed to heavy winds.

In the spring the number of bines to each pole is selected. These should not be more than two; but it is best when the wire-worm is apprehended to reserve two more against their depredations, and until danger to them is past.

The bine should be fastened to the poles, as their growth advances, with woollen yarn; and it is best when unravelled from a stocking, as it is more elastic. Women and children can do this work.

Tillage.—The grounds should be kept free of weeds or grass, and the hills almost level. The bines should be supported the first season on small poles, so that their better growth may be encouraged.

In the spring following the grounds should be well and deeply broken up as soon as the soil is in a proper condition. Care should be taken not to do this when it is too wet. The furrow should be thrown from the hill, and the hill itself carefully weeded and pulverized, either with the cultivator or the hoe. The land should be levelled in the subsequent ploughings with the cultivator. No better general directions can be given than to say that the hop should receive equal cultivation with the corn. A clean, mellow soil must be maintained. How to do this will require a less or greater labor, according to the season, and the cultivation will be modified by it. Sometimes the cultivator is all that is needed after the first breaking up; at other times, when heavy, soaking rains have compacted the soil, it will be necessary to again loosen it with the bull-tongue.

I have already spoken of the use of lime for the hop. If the soil is deficient in it, quicklime should be spread over the grounds and harrowed in, or covered with the cultivator. In subsequent years ammoniacal manures, as the superphosphates or guano, may be used, and should be, if the bines have been attacked by the lice. These should be placed around the hills and hoed in. The quantities should be in proportion to the demand for them; and this must be determined by the general richness of the soil, and by the severity of the attack of the lice. But in England as high as 112 pounds of phosphates, or 336 pounds of guano, have been used per acre.

Every operation demanded by the season should be performed in due time; and the more unfavorable the season is, the more cheerfully should be the labor given; for, in the cultivation of the hop, more than in all other crops, is the proverb true that "the hand of the diligent maketh rich." "In such years," says Mr. Manwaring, "it will far better requite the labor bestowed, yielding a better price, by reason of their scarcity, than in fruitful years, when almost every ground produces hops. Industry and ingenuity are most encouraged and best rewarded at such times, but ignorance and sloth come off with loss."

PICKING, DRYING, AND PACKING.

1. *Picking.*—Although it has been often said that "a September wind should not blow on the hop"—meaning that the picking should be done before the beginning of that month—yet, usually, the harvesting of this crop does not commence until about the first of September. When the hops begin to change their color from green to brown, and emit a fragrant odor, they are ripe. Mr. Rouse says that the hop should be in full perfection before it is picked, and this is known when the seed has changed from a bright straw-color to a pale brown, and emits a fragrant smell. But the most perfect description of the ripeness that demands immediate picking we find in Morton's Cyclopædia:

"A hop," he says, "may be considered ripe when it becomes hard and crisp to the touch; when the extreme petal projects in a prominent manner at the tip of the hop; when the color is changed from a light silvery green to a deep primrose or yellow; and when on opening the flower the cuticle of the seeds is of a purple color, and the kernel or seed itself hard, like a nut. Even after the hop has attained a lightish brown color no real injury to its quality will have accrued, and, for many purposes, such hops are most esteemed in the market; but, after the hops generally attain a dark brown hue, a great loss, both in quality and weight, will be sustained."

It is better to begin early than late in picking; but care must be observed lest the picking may commence too early. When in a proper stage of ripeness, four pounds of undried hops will make one of dry, and five pounds, scarcely ripe, are required to make one when dried. The hop, then, it will be seen, does not admit of a lengthened harvest, and hence the hop-grower should timely secure all necessary aid; and that aid, when promised, under no circumstances should fail, as it so often does, in the harvesting of other crops.

As to the picking itself, we cannot add to what Mr. Rouse has said:

"The hops are commonly picked in large boxes, containing from twenty-four to forty bushels. These boxes are divided lengthwise by a thin partition, and then subdivided into quarters. They are raised a little from the ground, and have handles at the ends to facilitate their removal from place to place, as may be desirable. One man and four girls are allowed to each box. Each girl deposits the hops she picks in her own division of the box. An industrious hand can pick twenty bushels in a day without difficulty. It is the business of the man to supply the boxes with poles, which he raises from the ground as needed, cutting the vines about a foot high; to see that the picking is properly done, to remove the empty poles, clear them of the vines, and stack them in a systematic manner. In picking, the hops should be kept free from stems and leaves, and all blasted or immature ones should be rejected. The boxes should be emptied at least once a day; at all events, no hops should be left in them over night."

2. *Drying.*—It will be seen that three-fourths of the weight of the hops are water. So large an amount in so much bulk, and to which the air penetrates, demands that the drying should at once follow the picking, or heating and fermentation, when in bulk, will speedily follow. The picking cannot, therefore, be in advance of the operations of the dry-house.

It is not intended to give a minute description of the dry-house, nor the different modes of constructing it. The following general description by Mr. Rouse will be sufficient for the purposes of this article:

"The hop-house, or kiln, should be of a size proportionate to the quantity of hops to be cured, so that they may not accumulate on hand. To avoid this, it will generally be necessary to keep the kiln heated both day and night. It is commonly built of an oblong form, and of two stories, the lower part being occupied by the kiln and the press-room, and the upper part by the drying-floor over the kiln, and by a room of about an equal size for storing the dried hops, which will of course be over the press-room. Kilns are sometimes built of bricks or stone, of a circular form, with a round opening in the apex of the roof, surmounted by a movable cowl, or swinging ventilator, to enable the vapor of the drying hops to escape easily. If the building is of wood, the sides of the kiln should be lined with brick-work, or thoroughly lathed and plastered. It is found to be most convenient and economical to heat it with stoves, from two to four of which will be necessary, according to the size of the kiln. The drying-floor should be ten feet from the ground, that there may be no danger of scorching the hops in drying. This floor is formed of slats about one and a half inch in

width, and the same distance from each other. These are covered with a strong coarse cloth, of open texture, so as to admit of a free transmission of the heated air from the kiln below. The drying-room should be of comfortable height for a person to work in it, and the sides should be lathed and plastered, that there may be no irregularity of the heat in different portions of the room during high winds. A good ventilator should be provided in the roof, as described above. Openings should be left in the walls near the bottom of the kiln to admit fresh air from without, the draught to be regulated by means of flues, or sliding doors. The cloth for the drying-floor should be well stretched over the slats and firmly nailed. On this floor the hops are spread to the depth of six or eight inches. The proper thickness will depend somewhat on the condition of the hops; if they are very full of moisture, they should be laid on quite thin; but if gathered when fully ripe, and in fine weather, a depth of ten inches will be allowed."

The chief point in the construction of the dry-house is to maintain a strong current of air through the hops, that the evaporated moisture may be carried rapidly out of the building, else its accumulation would, by its condensation, prevent the drying of the upper portions of the hops.

"The great object," says Mr. Morton, "with the hop-drier is to get rid of the condensed vapor from the green hops as quickly as possible, and the dry-houses should be so constructed as to effect this object perfectly. It must be borne in mind that hops should be dried *by currents of heated air passing rapidly through them, and not by radiation of heat.* This is a distinction of the utmost importance, since success is entirely dependent upon a strict adherence to the former principle. In order to accomplish this effect, the space above the hops must be kept hot, and all the lower parts of the kiln cold, whereby the greater density of the cold air will force the rarified air above, carrying with it the vapor from the hops, through the aperture or cowls upon the summit of the building. To aid this ascent of the heated air passing through the hops, a stream of heated air is sometimes thrown *above* the hops through a tube, thus adding greatly to the heat of the current passing through the hops, and giving it a greater ascending power."

Mr. Rouse thus continues his directions for drying:

"The hops being spread as evenly as possible, the fires are immediately kindled in the kiln, and the temperature regulated to one uniform degree of heat. This, however, may be quite high at first, as there will be at that time but little danger of scorching the hops if the floor is sufficiently high. If the hops are rusty, or discolored from any other cause, it is usual to burn a little sulphur under them, which will bring them to a uniform appearance. This is done as soon as the hops are well warmed through, and feel somewhat moist. Great prejudice formerly existed against the use of sulphur in drying hops; but no objection is now made to it by the brewers, and it is generally thought that the use of it improves the appearance of all hops, and that it also facilitates the drying.

"During the drying process the fires should be kept up, and there should be a free supply of fresh air below, sufficient to keep up a regular succession of heated air from the kiln, passing through the hops and out at the ventilator, carrying with it the vapor expelled from the drying hops. This will be found far preferable to a still, dead heat. As soon as the upper part of the hops appears to have felt the fire, the lower part may be considered as nearly dry, and will rattle a little. The heap may then be turned. Before this is done the heat should be suffered to abate a little, and increased again after the turning is finished. I am aware that many do not turn their hops while drying, nor suffer them to be disturbed at all until they are ready to be removed from the floor. Still, the better opinion, I think, is in favor of turning as tending to facilitate the drying and render it more perfect by the more effectually exposing every portion of the mass to the action of the heated current of air, than would be the case were they allowed to remain as at first deposited on the floor, containing many inequalities in density even when the utmost care is exercised in their distribution. If turned at the right time, and in a careful manner, there need be no injury done to the hops. When sufficiently dried they should be allowed to cool off a little, if time can be afforded, otherwise there will be great danger that they will break in moving, or a portion of them shell off and waste. Ten or twelve hours are required to dry a kiln of hops. Two kilns may be dried in twenty-four hours by keeping the heat up through the night. A twenty-foot kiln will thus dry 400 bushels in a day, as they come from the vines, making about 750 pounds of hops when dry."

So important is the manner in which the drying should be done, that to these directions I add those of Mr. Manwaring. After urging the necessity of using such fuel as will keep up a regular heat, he says:

"Let not the heat slacken, but rather increase it, till the hops are nearly dried, lest the moisture and sweat which the fire has raised fall back and discolor the hops. For these reasons chiefly it is that no cool air should be suffered to come into the kiln while the hops

are drying. After the hops have lain about seven, eight, or nine hours, having left off sweating, and leap up when beaten with a stick, then turn them with a malt shovel or scoop made for that purpose; let them remain in this situation for two or three hours more, till every hop is equally dried. They must not be turned while they sweat, for that will scorch and cause them to lose their color; the fire may be diminished a little before they are turned, and renewed again afterwards: the heat should be kept as equal as possible. It may be of service to make use of a thermometer, by marking upon it the degree of heat proper for drying hops, as soon as that degree is ascertained by experiment. Mistakes are often exceedingly detrimental to the hops, and great attention is required by the drier, night and day, until finished.

"When they are thoroughly dry, which is known by the brittleness of the inner stalk, (if rubbed and it breaks short,) the fire should be put out, and the hops taken from the kiln into the cooling-room. Here they should be spread out not exceeding twelve inches in depth, and in a day or two will be ready to bale. Care should be taken to exclude a drying air from the cooling-room."

3. *Baling.*—These directions of Mr. Rouse are brief and good:

"The hops being dried, the next process is to bale them. This should not be done immediately after they are taken from the kiln, but they should be allowed to lie a few days in the store-room till they become a little softened, otherwise their extreme brittleness will cause them to be much broken in baling, and the sample be thereby greatly injured. The bales should be of a symmetrical and convenient form, and should contain about 200 pounds. They are formed in a box or bin prepared for the purpose, in the press-room, of such shape as will give the desired size and form. Across the bottom and sides of this box the baling cloth is first laid, and the hops are then let down into it from above and trodden down as they are dropped in until it is filled. Another cloth is then carried over the top, a follower applied, and the screws of the press turned down upon it until the whole is brought into a compact mass. The box is then taken apart, the cloth neatly secured around the bale, the screws are run up, the bale taken out and the ends cased, when it may be considered finished, and the same process is repeated in forming another."

GARDEN VEGETABLES;

PARTICULARLY

THE ONION, THE CABBAGE, AND THE SQUASH.

BY T. G. HUNTINGTON, HADLEY, MASSACHUSETTS.

THE raising of garden vegetables and small fruits is an important and growing interest. It concerns every man who has a rood of land for cultivation, and it has much to do with the health, comfort, and thrift of every family in the land. Although no advocate of a purely vegetable diet, we firmly believe that a well-kept garden, which through the season furnishes a good variety of fruits and vegetables, will be found to lessen considerably the expenses of the family, to secure its more uniform and better health, as well as to lubricate the machinery of its life generally.

We may form some idea of their importance in our social and political economy by referring to some statistics of a few of the States, more particularly to those of Massachusetts, selecting the latter as in some respects the more striking example. In 1860 the value of this interest in all the States was something over twelve millions of dollars. Of this, New York represented, previous to the last census, relatively the largest share, Massachusetts the second, and New Jersey the third. Since that time New Jersey, owing to the superiority of her climate for early vegetables and fruits, and the increasing stimulus of the

New York and Philadelphia markets, has taken the second rank, and Massachusetts the third. The population of Massachusetts in 1850 was 994,514; in 1860 it was 1,231,066. The rate of increase from 1850 to 1860 was 23.79 per cent.

The increase in the productions of her market gardens is as follows:

In 1840 it was	$283,904
In 1850 it was	600,020
In 1860 it was	1,397,623

More than doubling in every ten years. The increase in the State of New York was in nearly the same ratio, while in New Jersey it must have been larger. So it appears that while our population increases for the last ten years at the rate of less than twenty-five per cent., the productions of our market gardens have increased more than one hundred per cent. in the same time. But the growing value of this interest will better be seen when we compare it with some of our other productions.

Massachusetts produced in 1860:

Of butter 8,297,936 pounds, which at 16⅔ cents	$1,382,989
Of potatoes 3,202,517 bushels, which at 33⅓ cents	1,067,506
Of corn 2,157,063 bushels, which at 75 cents	1,617,798

It will be seen, therefore, that, taking the three important staples of butter, potatoes, and Indian corn, the yearly produce of her market gardens exceeds that of the two first named, while it nearly equals that of the latter.

But this is not all. The corn crop of Massachusetts, while on the increase from 1840 to 1850, has since that time decreased. The potato crop has steadily declined since 1840, while the increase in the production of butter for the last ten years has been but slight. In striking contrast to this is the fact that since 1840 the produce of her market gardens has increased nearly five-fold. We are well aware that these facts will not apply to all the States, perhaps to but very few of them to their whole extent; but they are, nevertheless, instructive. They show us what direction our industry is to take as the resources of the country become further developed. While the production of grass and hay, and in some sections the various kinds of grain, will always claim the chief place in our regard, the produce of our market gardens and orchards cannot fail to be looked upon as a very important interest, and one of daily increasing value.

It becomes the intelligent farmer, then, to watch this tendency, and while he is careful not to run rashly into new experiments, still to be ready to avail himself of any opening in this direction; even should he anticipate to some extent the public want, he can hardly be a loser in the end.

Having said thus much on the importance of vegetable productions, a few general remarks on the requisites for successful cultivation may not be out of place.

One of the first of these is a proper soil. This is what is called a warm or quick soil. It is true there are certain vegetables which thrive in that of an opposite character; but for a market garden, or even for one merely for the family, where of course an early and various product is required, there is hardly anything that will compensate for this. If, then, the soil is not naturally of this description, in order to secure the best results its defects should be overcome as far as may be by artificial means. There will, of course, be draining, and if the soil is stiff and retentive, a mixture of some lime, &c., to break it down and render it friable.

The next point is abundant manuring. Nothing is better for this purpose, perhaps, than well rotted barn-yard manure. Fresh dung is very well in certain cases, but the general effect of it is to give a coarse plant with a disagreeable or, at least, inferior flavor. (Mr. Bull, the originator of the Concord

grape, in a lecture a short time since on grape culture, stated that some pungent, ill-flavored article applied to the vine in some particular instance as a manure for experiment or otherwise, was distinctly traced in the fruit.) In lands recently devoted to garden purposes the object should be to create as soon as possible a large supply of rich mould, for it is in this that vegetables luxuriate. In order to insure this, well rotted turf is excellent, or the deposits of leaves in the woods. If these are taken and used abundantly as bedding for stock, and there composted with the droppings, they make one of the best dressings for general garden culture. In connexion with barn-yard manure (for they should never be relied on exclusively) there are special fertilizers suited to various crops, which may be used to good advantage. Guano is excellent in many cases, especially when used with plaster, though it requires care in using. The latter is good alone for leguminous crops, such as peas, beans, &c.; but, perhaps there is no single article suited to a greater variety of crops than pure bone superphosphate—that is, ground bone dissolved in sulphuric acid, not the diluted article which is generally sold under that name. The writer knows of striking results from the use of this fertilizer both in garden and field culture.

A third requisite in successful gardening is a knowledge of the best methods of cultivation. This, though the last, is not the least point to be considered. In fact, it is just here that success or failure most often hinges. Any novice in gardening may select a suitable spot of land for his purpose, or by the proper means he can make it nearly what he would have it. He can supply manures in the greatest variety and abundance, as well as of the best quality. He may even so manipulate with these two as to put them into the best possible condition for the reception of the seed; and yet, if his proceedings thereafter are at fault, partial or even total failure may result; sometimes a single mis-step may destroy the hopes of a season. It is here that experience is an invaluable guide. She observes and treasures up a thousand trifles which are not thought worthy of a place in books; and yet, trifles as they seem, they often contain within themselves the secret of success or failure. In many instances the choice of a variety, the selection of seed, the manner or the time of planting, are things of the first importance. We have known beans to be so planted as never to come up, or to have spent so much of vital energy in the process as to accomplish nothing afterwards; so, too, a slight difference in the planting of corn has in the result made the difference between a fair crop and almost total failure. So it is through the whole round of garden culture. While there is much to be learned from books, there is nothing like personal contact with nature to draw from her the secret laws of vegetable life, so that she may be assisted in converting the embryo life into so many and useful forms to meet the wants of man.

Having in this general and cursory way spoken of vegetable culture and called attention to its increasing importance, we now propose to take up two or three articles, those which by the great use made of them are the more prominent, and treat them somewhat in detail, deeming such a course more useful than to go over the whole ground of garden culture. Leaving out, then, the potato, which has already received a large share of study and observation, we have selected for this purpose onions, cabbages, and winter squash.

ONIONS.

The importance of the onion will be conceded by all. It not only enters largely into our home consumption, but is becoming an article of export. In the year 1859 the value of the crop exported was over two hundred thousand dollars, a little more than the value of apples exported the same year. It is both wholesome and nutritious, and is especially valuable for its anti-scorbutic qualities.

As an instance of the increasing demand for this esculent, it may be stated that many inland towns have lately commenced its cultivation, and although the area devoted to it is becoming more extended every year, the price has been continually rising.

Dr. F. Unger, in his sketch of the plants used as food by man, published in the Patent Office Report of 1857, says that "the onion is probably indigenous from Palestine to India, whence it extended to China, Japan, Europe, and North Africa. It was highly prized by the ancient Greeks, the Jews, and the Egyptians. The island Cimolus was endowed with the surname of Onion, because onions of remarkable excellence were cultivated upon it. Unfortunately we have no means of knowing the method of cultivating them, or whether it was owing to them or to some peculiarity of soil or climate that their superiority was to be attributed. This being the case, we shall have to refer to the best practice of later times.

The first and most natural question that presents itself relates to the character of the soil best suited to this crop. What should it be? To this it may be answered that they admit of considerable range in this respect. We have seen them growing well, both as regards quantity and quality, on a great variety of soils—on recently cleared light plain lands, on alluvial bottoms, on rather cold clayey loam, and they seem equally at home on the western prairies. Writers on the subject who are good authority say that the soil best suited to them is a dark sand, or one rather inclining to sand than clay. Manure should be applied in great abundance, as there seems to be little danger of over-feeding the crop. Heavy manuring is important, as giving the plants a vigorous start and so securing a healthy growth, and pushing the crop beyond the attacks of the maggot. As a principal dependence there is nothing better than well composted manure from the barn-yard or hog-pen. In some parts of Essex county, Mass., which has long been famous for its onion culture, and where comparatively little barn-yard manure is made, a compost of peat, sea-weed, and night soil is used with great success. As special fertilizers, first guano, superphospate, and ashes are excellent, the two latter to be applied to the drills after sowing. The next important thing after soil and manures is good seed. If the cultivator fails here, his failure is likely to be irreparable. Seed that "won't come" is acknowledged by all to be a nuisance, but it is not so well known that seed which will barely come is but little better. Indeed, practically, the effect is sometimes worse in the latter case than in the former. A few straggling plants coming up irregularly are apt to beget a hope which, however, almost always proves fallacious, that the ground will finally become stocked. So between hoping and waiting the opportunity is lost for replanting. The standing plants show but a puny growth; their unpromising appearance leads to neglect in cultivation; weeds take possession of the ground, causing a more diminished product, and so the whole operation ends in disappointment if not loss. Let all care, then, be taken to get seed that is uniformly plump and sound—seed that will not exhaust itself in pushing its germ into the sunlight, but waits only the proper conditions to start up into a vigorous and healthy growth. A marked illustration of the importance of good seed came within the observation of the writer the past season. A plot of ground was prepared, all of it in precisely the same way. In sowing, the seed fell short by some half dozen rows. It being not convenient to get more of the same seed, the want was supplied from another source, and the sowing finished. In due time the plants on the part first sown came up with a fine healthy look, which they kept through the season, making a crop fair in quantity and most excellent in quality, with very few scallions, although it was the first time the ground had been used for this crop. The appearance of the other part of the plot was a complete contrast through the season. A small portion only of the seed came; the germination was slow and feeble, and the plants through the season seemed

to lack vitality. The bulbs were coarse in texture and the scallions in much larger proportion than the others, making in all not more than half a crop.

The varieties most cultivated for winter use are the red and yellow. Of these the red is considered by some as more hardy and prolific. It is undoubtedly the coarser and more pungent of the two. The yellow, besides standing first in quality, is, on account of its keeping qualities, better adapted to shipping purposes than some other kinds. The Danvers, which is but a sub-variety of the yellow and equal to it in point of quality, possesses, from its peculiar shape, which is globular, an advantage over it in cultivation. This globular form will allow a larger number of bushels to stand upon an acre than the flat kind, a matter of some importance in the cultivation of so expensive a crop as this. While on the subject of varieties, it may be as well to say that the top and potato onions being raised chiefly for summer use, we pass them by, confining ourselves to what is of more general interest. We come then to the matter of cultivation, and here three things are of great importance, viz: careful preparation of the ground, early sowing, and thorough cultivation through the season. If the land is naturally inclined to be cold and wet, its preparation may be hastened by throwing it up into ridges in the autumn, so subjecting it to the action of frost through the winter. By this means it is not only the sooner made dry in the spring, but the mechanical division of the soil is much assisted. The most simple way of doing this is merely to make the furrows of double width, turning over in reality but about one half the ground and throwing the ploughed portion upon the top of the baulk or unploughed part. It is a good practice where this operation is performed to apply the manure at this time, covering it in the way mentioned above. As soon as the ground is ready to work in the spring, the furrows may be harrowed over and the land cross-ploughed, which will bring it into fine tilth. Where the fall ploughing is not done, the cultivator can pursue any course which he deems best, provided he secures the end sought, which is a fine light, smooth bed for the seed. Great pains should be taken here, as not only the thrift of the plants, but their economical cultivation, depends upon it. As the finishing stroke to this process, nothing is better than the hand-rake; it smooths inequalities, takes out all rubbish, and fits the ground nicely for the drill. The time of sowing will depend somewhat on the selection of a suitable piece of land. One that permits early working is much the most desirable, and there is no danger of sowing too soon after the ground permits free working. Early sowing is one of the essentials to success. So much importance is attached to this that some cultivators sow ashes upon the snow in the spring to hasten the thawing.

The amount of seed sowed per acre is about six pounds of the red, and five of the yellow or Danvers, and with this amount it is not thought necessary to thin the plants. As soon as they are large enough to fairly show the rows, the ground should be run over with the hand cultivator or hoe, and within a week or ten days later the first hand-weeding should be performed. It is impossible, however, to lay down rules here unless it is the single one, never to let the weeds get the advantage. Small weeds are more easily killed than large ones and with less injury to the crop; and besides this, a clean field will almost pay for the pleasure it affords to the eye. The labor of weeding may be performed by children after a little practice. We found, during the last season, which was very dry, and therefore unfavorable to the growth of weeds, that the ground needed clearing about once a fortnight.

After the crop is matured, which is known by the tops falling over, the onions may be hoed or raked out of the ground and left to cure for a week or two, when they should be topped and removed to some dry place under cover, where they can remain as long as there is no danger from frost or until they are sent to market. The onion is much inclined to grow after being harvested, and the condition of success in keeping them is said to be a low dry tempera-

ture without frost. To secure seed Burr gives the following directions: "Select the best bulbs, set them out in April in rows 2½ feet apart and one foot apart in the rows. As the plants grow tie them up to stakes. The seeds ripen in August; when the heads assume a brown color they should be cut off, thoroughly dried and threshed, when they can be put away for use."

The cost of raising varies in different localities. The price of manures, of labor, and the character of the land, both as regards foulness and natural fertility, are items that will affect considerably any estimate that may be made. Our own experiments, in a small way, the past season, show a footing up of some two hundred dollars per acre besides rent of land.

Of this sum about one hundred dollars, or at that rate, was paid for seed and fertilizers. One of the largest growers in this region estimates the average expense this year, including manures and rent of land, at two hundred dollars. The produce varies still more than the expense, ranging from one or two up to eight or ten hundred bushels per acre, according to the skill of the cultivator and the freedom of the crop from its usual casualties.

It is well known that its most formidable enemy is the maggot; so serious have become its depredations, that in some sections where the onion was once the staple crop its cultivation has been nearly abandoned. No preventive has yet been found, but the best chance to avoid the evil seems to lie in taking up new lands. The objection to this is, that the first crop is likely to be imperfect, having a large proportion of scallions. We would suggest as a remedy for this, and as enhancing the prospect of success, a thorough rolling of the ground, both before and after sowing, and if the last can be done with a hand-roller so much the better, as the feet of oxen or horses are very apt to press in a part of the seed too deep, making it come up unevenly and hardening cultivation.

We have thus endeavored, in as few words as possible, to point out the best methods in the cultivation of this important esculent. At present prices, it certainly equals the tobacco crop in point of profit, and far exceeds it in that of utility.

There is almost a guarantee that it shall not become a drug, in the fact that it cannot be easily raised as a winter-keeping vegetable in southern latitudes. Owing to this, it becomes an article of export, and takes its place as one of our staple productions.

CABBAGE.

Under the head of Brassicaceous plants, Burr, in his Field and Garden Vegetables of America, enumerates kale, broccoli, Brussels sprouts, cabbage, cauliflower, colewort, Portugal cabbage, Chinese cabbage, Savoy and sea kale.

These are divided into numerous varieties, each possessing the same general characteristics, and yet distinguished for their habit of growth, their appearance, their flavor, or some other quality peculiar to themselves. Of these we have selected the cabbage, as not only the most important of the Brassica family, but, as next to the potato, perhaps, the most largely used of any vegetable esculent in New England or the northern States. Especially has this been the case since the introduction of so large a proportion of the foreign element to our population. Among the Irish, the German and the French, at least the Canadian French, in its season, and in one form or another, it furnishes a staple article of consumption. And there is good reason for this, since the cabbage is one of the most nutritious vegetables grown, containing, according to Johnson, when deprived of its water, about 35 per cent. of tissue, forming compounds such as albumen, &c., and 46 per cent. of starch and sugar, while the potato contains only nine per cent. of the former, though it is richer in starch than the cabbage. It is a curious fact, and affords a good illustration of that instinct by which man

in his natural and simple state lays hold of those productions the nearest allied to his wants which his circumstances will allow, that being unable to procure in their native country a free supply of meat, these hard-working people have substituted for it two vegetables the best calculated to supply the waste of muscle and sinew occasioned by their daily toil.

We have no means of ascertaining its comparative value among the productions of the country, or the part that it plays in the support of its population; but if there were any statistics, as there should be, by which these points could be proved, probably its importance would be a matter for surprise to the superficial observer. Its great use for culinary purposes is not confined to this country. Dr. Unger, whom I have already quoted, says: "No kitchen garden in Europe is without it, and it is distributed over the greater part of Asia, and, in fact, of the entire world. The original plant, undoubtedly, occurs wild at the present time on the chalk rocks of the sea province of England, and on the coast of Denmark and northwestern France, and it is a question whether this marine plant did not at one time have a much wider distribution where the climatic peculiarities of Europe were different from what they are now." Its value is not limited to the various culinary uses to which it is so well adapted. As a forage crop it is hardly less important. Wherever a system of soiling is pursued it should come in as a supply for the stock, or at least as a principal share, for at least two or three months in the year. Coming, as it does, immediately after the autumn frosts, when green corn is no longer to be had, it affords the very best supply of green feed until the first of December, and, by a little care, even until the first of January. And, although it may not be practiced to its full extent, it is well worth while for every farmer to have his half acre or acre of cabbage to keep up the flow of milk when the pastures begin to fail. We speak from abundant experience in this matter. This very season, a cow which had been running in a pasture and making but four pounds of butter per week, was taken into the stable and fed with forty pounds of cabbage a day, with what hay she wanted, which was but little. Her flow of milk immediately increased, so that it produced six or seven pounds per week. It is thought by some that cabbages, like turnips, produce an unpleasant taste in the milk and butter. It is believed to be a mistake. Certainly it has not been the case in our experience. Only a few weeks since we subjected to the taste of a connoisseur an article of butter made from the milk of cows fed in this way, comparing it with another made from well-kept cows, but without the cabbage, and he was unable to detect any difference between the two. If any one has acquired a prejudice of this kind, it has probably arisen from the fact that the stumps and decayed leaves have been carelessly fed out with the other parts. This being the case, it is no wonder that milk should have an unpleasant taste. The cow, when at liberty, selects her food with sufficient care, but if confined, in her eagerness for anything green, she is not so particular, and needs to have her food prepared for her clean and sweet.

The relative value of cabbages, compared with other vegetable food, is shown by Professor Johnston in his Agricultural Chemistry, page 359, where he says: "In the case of the ox the daily waste or loss of muscle or tissue requires that he should consume 20 to 24 ounces of gluten or albumen, which will be supplied by any of the following weights of vegetable food:

	Pounds.
"Meadow hay	20
Clover hay	16
Oat straw	110
Pea straw	12
Oil cake	4
Turnips	120
Cabbage	70

	Pounds.
Wheat	11
Potatoes	60
Carrots	70
Beans and peas	6"

From this table it appears that cabbage is worth as much, pound per pound, as carrots, and nearly twice as much as turnips. This is probably much more than the popular estimate, but is, no doubt, correct.

Among market gardeners the value of the cabbage and its proper cultivation are much better understood than with the mass of farmers through the country. The great object with the latter has been to get the necessary supply for the table, and with their method (or rather want of method) they have hardly succeeded in this. In our boyish days the first sign of gardening operations to be seen in the spring was a row of cabbage stumps, whose heads had been consumed during the preceding winter, looking most hopelessly forlorn and crest-fallen, as they literally were. The shoots that sprung from these stumps, in the absence of asparagus and other vegetables, which later improvements have introduced, were the main reliance for greens, and what were not wanted for this purpose were allowed to go to seed for the next year's sowing. Under treatment so grasping and short-sighted, it is not to be wondered at that this product of a generous cultivation fast dwindled away to its original type and refused to seed. Scarcely less surprising was it that its cultivators, in their ignorance of the laws of reproduction, should have supposed that they could remedy its defects by inverting its position, putting the top where nature intended the roots should grow.

Another bad practice pursued in the cultivation of this vegetable has been confining it to old gardens, where it is liable to become club-footed and so worthless. A better method, however, is beginning to prevail, and the production of field cabbages, both for the market and as a forage crop, promises to become a permanent and important interest. The foregoing considerations have induced us to select this as one of the vegetables deserving more particular attention than it has yet gained. From the great diversity of climate in which the cabbage is found we rightly infer its hardihood and easy adaptation to different localities. As its home is on the seaboard, however, it is natural to suppose that in such places it will be found in its greatest perfection, and such appears to be the fact. It is presumed that Essex county, Massachusetts, particularly Marblehead, can boast of a success in this line equal at least to any in the country. We have heard of entire fields there averaging the most extraordinary produce of thirty pounds per head. But it yields to good treatment in almost any soil, though what is called a strong soil is as good as any, if not too cold and stiff. The preparation of the ground, where the best results are sought for, should not be inferior to that for the tobacco crop. It should include two ploughings, with sufficient harrowing, to make the ground light and fine. If it is at all stiff and unyielding, fall ploughing, like that recommended in the cultivation of onions, will be found very beneficial. One point of considerable moment is to have the last ploughing immediately before the plants are set. Especially is this necessary if the ground is at all dry, as it much facilitates their establishment and subsequent growth.

Our own experience leads to the conclusion that composted manures are better than fresh, tending to produce plants of a finer flavor, and less liable to club-foot; and this is the opinion of those who are considered good authority on the subject. Some good cultivators make use of a compost of peat and night-soil, well incorporated together. Manuring in the hill is recommended by some, but it is believed that the better way is to enrich the ground sufficiently at the first ploughing to secure a good crop, without being obliged to resort to this

method. Guano and superphosphate may be used as special fertilizers, and salt, at the rate of ten bushels to the acre.

Before proceeding further, it will be necessary to dwell somewhat upon the production of the plants in their early stages, for upon these the value of the crop depends. The first point, of course, is good seed; and this means that it must not only be sound, but properly grown, otherwise there is no certainty that the crop will head well. There are some seedsmen who can be depended upon to produce a genuine article, but there are too many that are not sufficiently careful in the matter. There is no need, however, that the cultivator should be dependent on the seedsman for his supply, as, by a little pains-taking, he can raise his own. Burr's directions for obtaining seed are to select perfect heads and set them three feet apart each way. As they grow remove the side-shoots and encourage the main sprout, which will push up through the centre of the head. Seed thus cultivated for a few successive years will produce plants ninety per cent. of which will yield well-formed and good-sized cabbages.

There are many varieties to choose from, among the most popular of which, perhaps, are the Early York, said to have been introduced to England from Flanders, more than a hundred and fifty years ago, by a returned soldier, who settled in Yorkshire as a seedsman, whence its name; the Winningstadt, a little later than the York, and larger, with a very solid head; the Bergen, raised largely for the New York market; the Premium Dutch and the Stonemason, originated by Mr. Stone, of Marblehead.

Having selected a suitable seed-bed, which should be fine and rich, prepare it well by ploughing or digging and raking; sow the seed in drills about a foot apart, and roll or spot the ground smoothly, so that there shall be no lumps for insects to secrete themselves under. The great care at this period will be to have a bed rich enough to give the plants a good start, to have moisture enough to induce an even and quick germination of the seed, and to ward off, if possible, the depredations of the turnip fly. Their attacks are sometimes made before the seed leaves are fairly visible, and so rapid is their work that the careless observer concludes his seed has never sprouted. There are various expedients resorted to for the purpose of preventing this mischief, which will be considered more at length in another place. Here it will be enough to say that the writer succeeded the past season in saving his early turnips and cabbages by applications of black pepper and flour, sprinkled on the drills while the dew was on, and just as soon as the plants could be seen. The sowing of the seed should be made about the middle or last of May; another made in the early part of June may be of service in re-setting, when the first setting fails, as it sometimes does. Sowing in drills has these advantages over broadcast sowing, that the beds are more easily kept clean, and applications to ward off the fly are more conveniently made. Besides, there is a saving of seed in drill sowing; and the operation of thinning, which should never be omitted when the plants stand thickly, is accomplished much more advantageously when they stand in rows than when irregularly over the bed. This thinning should not be done until the plants are well out of the way of the fly, and they should be left an inch or two apart, in order to insure a stocky growth, with a strong stem and abundance of roots. The plants taken up may be set out in another bed, and will be every way as good, but a little later than the others. Fine plants may sometimes be obtained by mixing a small portion of cabbage seed with that of carrots or beets when these are sown. In this way, standing singly, they have plenty of room; and, being transplanted before the carrots have attained much size, they do no injury to that crop. Some cultivators prepare the whole field and plant a few seeds to each hill, thinning to one plant when large enough to be secure against casualties. This course has been recommended in regard to the Stonemason and the Marblehead Mammoth Drumhead. In common field culture it seems open to the objection of more care and labor

in guarding against the fly, and also of at least one extra cleaning of the whole field. This has been our experience, though the objection may not apply to more favored localities. Transplanting into the field is usually deferred until a rainy time; and when one is not obliged to wait too long, it is, without doubt, the best way, though it is not essential. There is a time beyond which it is not desirable to have plants in the seed-bed, and rather than have this much extended it is best to resort to artificial watering. The time for setting for a winter crop is from the first to the middle of July. If the land is backward, they may be set in the latter part of June. With good management, a crop may be produced after an early crop of peas. The cabbage is tenacious of life, and in the absence of rain it is only necessary to prepare the ground in the usual way, and after making a hole with the dibble fill it with water and set the plant. Another watering within twenty-four hours will be sufficient in ordinary times. This method has been tried in rather a dry time, and in the middle of a bright day, with perfect success. We pass over the operations of setting, as a matter with which all are familiar. One point, however, should be observed, which a novice might overlook, and that is, to set deep. If the crown of the plant or inside leaves are kept free, there is little danger of overdoing in this way. Having secured a good set or stocking of the ground, the after cultivation consists in keeping it clean and light. Perhaps no vegetable pays better for a frequent stirring of the earth. Stories of wonderful results are reported when this seems to have been the chief means employed, and testimonials in its favor are so abundant that there is no doubt of its great importance. If the crop has succeeded well, it will be fit to harvest by the first of November, or soon after, though it may stand with safety as long as the weather continues open. If there is danger of the heads bursting previous to gathering, start the roots, to stop further growth. Owing to their great bulk and liability to decay, it is a somewhat difficult matter to preserve them in large quantities in our common cellars. One way is to hang them up by the roots; another is to thin off the outside leaves and stumps and pack in barrels; still another is to set them out in the cellar as thick as they can be made to stand. We know of a cultivator who preserves a thousand or fifteen hundred heads in this way in excellent condition. Where the object is to keep them in very large quantities over winter, pits are dug of the size necessary to contain the required number, say a foot or eighteen inches deep; into these the cabbages are packed as tightly as possible, in an upright position, and over the whole enough litter is thrown to protect them from severe frost. A slight degree of frost does not injure them if they are kept at an even temperature. In addition to these methods, they are sometimes pitted by digging a trench in a dry place, wide enough to hold the heads, and about a foot deep. Into these trenches the cabbages are put, head downwards, and covered with boards and earth or litter.

Perhaps, in an essay of this kind, a short space should be devoted to the Savoys, which, though coming under the head of Brassicaceous plants, are regarded by Burr as a distinct family. The Savoy takes its name from the country where it originated, "having been introduced from Savoy more than a hundred and fifty years ago. It is distinguished from the common cabbage in appearance by its more open head and by the wrinkled appearance of the leaves, which are also of a lighter green than most other kinds, while in texture and flavor it is thought to approach some of the broccolis or cauliflowers." It is very hardy, but somewhat slow in growth. As a table vegetable it seems worthy of more attention than it has hitherto received. The cabbage, like most other cultivated crops, is subject to the attacks of insects, which are sometimes very troublesome. The first is the fly or black bug, of which mention has already been made. As prevention is better than cure, we give, in addition to what has already been said on this point, two methods of warding off its ravages: "Steep the seed in a pint of warm water two hours, in which is infused an ounce of

saltpetre; dry it, add currier's oil enough to moisten the whole, after which mix with plaster enough to separate it, and fit it for sowing." The other is the following: "After preparing the ground in the usual way for the seed-bed cover it up thickly with almost any kind of combustible rubbish; burn this to ashes, and rake the ground and sow the seed, and no insects will attack it while the effects of the fire remain. Another troublesome insect is the black or cut worm, which does its mischief soon after transplanting. The only remedy yet known is to hunt for the depredators, (the morning is the best time,) and kill them, resetting as often as is necessary. Then there is the aphis, a plant louse, which sometimes inflicts serious injury. The writer knows of no remedy for this, but a single incident, which came within his observation the past season, may, perhaps, be worth relating. A small patch had been set, and, owing to the extreme drought, was with difficulty kept alive by frequent watering, until there was rain. About the middle of August they were almost covered with lice, and many of them promised but little. They were thoroughly hoed at this time, the ground being stirred deeply. In one week's time there was scarcely an insect to be seen, nor did they make their appearance again. Of course no general deduction can be made from an isolated fact of this kind. Possibly others may be familiar with a similar experience, and it is only with the hope of drawing it out, if such is the case, that this has been introduced. The club foot is a disease showing itself in an enlargement of the roots. If it appears in the early stages of growth, it is very apt to prove a fatal injury. It is most common in old gardens, or where the cabbage has been cultivated before. The remedy is to plant on a fresh piece of ground every year.

Notwithstanding these drawbacks, it is believed that this crop is one of the surest and most profitable that can be grown. It has this advantage, that if it is difficult of sale at any time, the home market is sure and fairly remunerating.

THE WINTER SQUASH.

The introduction and use of the winter squash is of comparatively recent date. Its origin is involved in obscurity; but from the fact that ancient writings contain no allusions to it, and that older European authors are equally silent in regard to it, it is reasonable to suppose that, like the potato, it is a gift to civilization from the New World. Its original home is supposed to be somewhere within the American tropics, whence it has spread over a large part of this country and Europe. As a table vegetable it takes rank in usefulness with the onion and the turnip, while for pastry purposes it is perhaps second only to the apple. It must be confessed, however, that it is not a great favorite with the masses, owing, perhaps, to its expensiveness and the care necessary in its preparation for the table. With those, however, whose tastes and means require a variety of dishes, the squash, from its delicate flavor and fine appearance, will always be regarded as a necessity. These considerations will make its cultivation by market gardeners in certain localities a matter of considerable importance. The change which has taken place within seventy-five years in regard to the use of this and some other vegetables is quite remarkable. In the last century the pumpkin was principally used for all those purposes for which the squash is now considered indispensable. Even later, and within the memory of comparatively young people, New England was famous for its pumpkin pies, while those made from squashes were almost unknown. At length the crooknecks were introduced and became popular, and these in turn have been in great measure superseded by the improved varieties. There is frequently considerable difference in texture and flavor in specimens of the same variety, and we have no knowledge of any method by which they can be produced of a uniformly first rate quality. In this particular approximation only has hitherto been attainable.

The varieties are numerous, and too well known to need any description here. They are in name the Crooknecks, Canada, and Large, the Autumnal or Boston Marrow, the Hubbard, and the Turban. This last, though perhaps not so well known as the others, has great merit, and promises to become a favorite. One of its peculiar qualities is its solidity, which (the squash being an article of great bulk) is an item of considerable importance in winter preservation. Two of the kind mentioned above, the Crooknecks and the Autumnal Marrow, are supposed to have been introduced by the Indians. Champlain found the bell-shaped species, from which came the Crooknecks, around the Northern Indians in 1605. And Mr. John M. Ives, of Salem, who introduced the Autumnal Marrow to public notice, says, in a letter to Mr. Burr giving an account of its origin, that he received the first seeds from a friend of his in Northampton in 1831, and that he was afterwards informed "that the seeds came originally from Buffalo, N. Y., where they were supposed to have been introduced by a tribe of Indians who were accustomed to visit that city in the spring of the year."

The squash thrives well on any rich warm soil, though newly cleared or broken sward-land is said to be the best for it. Being a native of a tropical climate, it is sensitive to cold, and should not be planted until the ground is warm enough to insure germination.

The hills should be made from six to eight feet apart, and a dozen or fifteen seeds planted in a hill, which should be prepared by digging holes eighteen inches in diameter, and one foot deep which should be nearly filled with well-rotted manure. Over this should be drawn a little earth, on which the seeds may be dropped and covered to the depth of an inch. If the soil should be stiff and unyielding, it is an excellent practice to cover with very light sandy loam, or even with sand alone, if care is taken not to let the surface get too dry. The object is to have a loose surface for the seeds to push through when they germinate. When clayey soils become packed, as they sometimes do after a hard rain, it requires considerable force to break the crust, sometimes more than the germinating power possesses, in which case the plant is crippled or crushed from the beginning. We have sometimes seen in such cases the ground broken for the distance of several inches in diameter, and raised to an angle of forty-five degrees to make room for the shoot.

It may be remarked here, in passing, that it greatly facilitates the coming up of all flat-shaped seeds, those which literally *come up*, to plant them in a vertical position and cover loosely. So necessary is this, that in some cases, in planting the Lima bean, for instance, the best way is said to be to lay them on the top of the ground, which probably means to give them the lightest covering possible to secure sprouting.

A strong compost made of night soil and common earth is a valuable dressing, causing a rapid and luxuriant development of the seed leaves, thereby lessening the chances of injury from insects, while the manure itself is said to have the effect of driving them away. The critical time for the squash is just at this period. Its enemies are the striped and the so-called squash bug. A pretty effectual way of destroying the latter, and to some extent the former, is to lay a broad shingle by the side of each hill as soon as the plants are up. The bugs seek the under side of the shingle for shelter in the night, and are easily killed early in the morning.

From the fact that the striped bug commits its depredations on the under side of the leaf it is difficult to reach it. Soot, lime, elder leaves, ashes, plaster, charcoal dust, &c., are recommended. We have seen within the past year a pyramid-shaped net, with a stake at each corner for fastening it into the ground, which must be a very good protection, and would not be expensive for garden purposes. If the crop escapes injury from insects, its growth is rapid. The plants should be thinned down to three or four to the hill, and the ground kept clean by frequent stirring until the vines cover the surface.

Before the frost comes the squashes should be picked and removed to some dry cool place. They should be handled with care, and should not be laid in large piles, as every bruise injures their keeping qualities. They are best preserved in the winter in a dry atmosphere, with a temperature uniform and but little above the freezing point. Large cultivators are in the practice of fitting up buildings for this particular purpose, where the squashes are arranged on shelves, so that they can be easily examined, where, of course, the temperature is regulated by artificial heat.

In our enumeration of varieties, not only of the squash but of the onion and cabbage, we have purposely omitted not only the description but the names of a large number, choosing rather to turn attention to a few well-known and standard kinds, than to occupy space and divide attention by allusions to those which have but little intrinsic value to recommend them, or which, if really as valuable, are not as much sought after as those we have mentioned.

IMPROVEMENT OF NATIVE GRAPES BY SEEDLINGS AND HYBRIDIZATION.

BY S. J. PARKER, M. D., ITHACA, N. Y

NOTWITHSTANDING the great interest now taken in grape culture, it is not to be expected that every one should be fully aware how much is done, nor by what means, nor what are the paths to be systematically followed to insure better results than any hitherto attained. In these few pages I shall attempt to give some information on these points.

The germ of the grape development now so extensive was the finding of the Isabella as a wild plant, or its production as a seedling, about the year 1818, by Mrs. Isabella Gibbs, the wife of George Gibbs, esq. Hence the name Isabella. Soon afterwards Major Adlum, of Georgetown, D. C., introduced the Catawba, a variety found by him in the vicinity of the Potomac. The successful and extensive cultivation of these two vines brought out a demand for other wildlings, which, with certain merits, have defects that render their culture unprofitable, For a number of years after this period, as is often the case likewise in art, literature, science, mechanics, and in horticulture generally, the public mind rested satisfied, and made little or no progress. Again came, but a few years ago, the demand for any and every wild vine of our national domain, a requirement that to some seemed extreme folly, but really producing benefits whose value is inestimable; for we hope to show that there are uses of these wildlings more worthy of attention than their undeveloped excellences. For certain purposes they still need to be generally diffused. Another method of improving our native grapes has added its influence to the tide of popular success, though but few have appreciated its distinctive effects. It is that systematic production and cultivation of seedlings which has really given us some of the best varieties now high in public estimation. A third method has been used for improving American grapes with truly wonderful facility and admirable advantages, that of hybridization. To these could be added the practice of collecting chance seedlings and varieties which promise well in their native sites and submitting them to change of soil, and to root and

branch pruning, manures, and repeated propagation, by which the habits and productions of plants are varied more or less. To these two, the systematic seedlings and hybridization of American grapes, as two of the main sources of improvement and for the radical cure of defects, we shall devote this article; for we believe there is a perfection attainable of which we have hardly a just appreciation. In the language of another, "It is the belief of our most intelligent grape-growers that American vines will yet produce grapes superior to any in Europe; their more pronounced flavor and aroma, too harsh, is to be brought to a true perfume, a brisk, delicious flavor, superior to the simple sweetness and delicacy of the foreign grape." As in sheep and cattle, no gain can be made unless there is virtue in the parent, an excellence of some sort; and hence chance seedlings or wild varieties constitute the base on which to operate.

It is doubtful whether the Catawba and Isabella were at first what they are now, but when diffused they found spots eminently suited to their wants. So of all others—their characters must be a matter of careful observation in many places. And when these are noted, then the changes to be wrought in them are as clear as ever was a desirable cross or hybrid in an animal. The reasoning is the same in one case as in the other. The chance animal may be valuable, as may the chance seedling grape. In common language, it is the well "weeded out flock" that has the best sheep, or the well "crossed herd" that develops the sought-for type in the mind of the propagator. And the same processes are the ones to be sought in the improvement of the grape. We doubt not that there are wild and chance varieties, now, perhaps, but little valued, which, when they have been cultivated as long and as carefully as they should be, will prove praiseworthy for flavor and salable in the market. But whether it is best for us to depend on this haphazard work is not a question worth discussing. We who can, should try any and every new variety, and thus aid in demonstrating their value or the want of it; but more than this, we should try the surer and quicker methods of hybridization and desired seedlings. The hybrids are some of them quite well known, though but little diffused, and the seedlings, which are not the result of accident, but of study, are also well known, and no dispute can be had on the perfect success that has attended either mode of improvement. In the choice of a grape for seedling or hybridization, it must be remembered that success requires a native "grape possessing absolute immunity from the usual vicissitudes of our climate." It should be hardy in this sense of that word. It must be early, prolific, large, handsome, such as every one will pronounce good without hesitation. It must be vigorous, for if not so the vine will require a rich soil and abundant manures to feed it. A strong-growing vine will give good crops on any fair land without manure—an absolute rule for making our wines, different from those in Europe, but more healthful and agreeable. "The vine should be prolific, that it may be profitable and easily pruned. The grape, both in berry and bunch, should be neat, comely, large, that it may sell well in the market. It should be early, to escape frosts." Perhaps no man is more the pioneer in seeding the grape than he whose language just given is an almost perfect rule in the art of systematic seedlings, Ephraim W. Bull, of Concord, Mass.; and perhaps there is no one with a greater present success in his attempts to fulfil his own well-expressed rule, for the Concord grape is established before the public, and it is a monument to him more enduring than marble. It incontestably settles the question that by his method of propagating the grape new and valuable kinds can be originated. He must ever stand as the first one who, out of a wild New England vine, brought forth a seedling with intelligent care, and that seedling, while he was yet in the prime of life, was adopted as one of the hardiest and most prolific of grapes, and planted largely over our national territory.

Perhaps, too, the seedling plan, though called slow in its journey to the gate of success, is not, after all, the longest road; for though we may have hybrids superior to the Concord in merit, yet we have none at the present moment as popular with the public.

As the case now stands, he who systematically seeds the grape has the best chance of immediate success in the result he reaps, while the hybridist seems to get more slowly into public favor. No one can more forcibly express the idea sought than Mr. Bull, and therefore I quote his words, which I have abbreviated somewhat:

"Raising new varieties from seed is probably the best method of obtaining improved varieties; therefore we may take courage and enter upon the task of growing seedling grapes. Many new grapes are chance seedlings, very good in their native localities, worthless or ill adapted to our climate; some good, but too small for market, poor bearers, slender growers, or requiring such attention as to make them unprofitable. A grape for general cultivation must have such constitution as will bear neglect, be comparatively indifferent to soil and location, and be always salable. Seedlings from our Labrusca will be most apt to succeed. He who shall obtain a new grape, improved in quality, will not only receive a handsome profit, but confer a lasting benefit on mankind. Having pursued it for nearly twenty years, I may, perhaps, save the beginner some time. I was led to it by the impossibility of ripening any of the grapes then on the lists, living as I do in the valley of the Concord. I turned my attention to our natives, believing that good grapes could be had of this stock. I wanted a grape that should be vigorous, hardy, prolific, early, with as good quality as possible. I found such a grape, a good eating grape for a wild native, and began with this. In five or six years the seedling bore fruit; the seeds of this were planted again, and from these latter I obtained the Concord. And from the Concord, in the third generation, I have grapes of great variety. The original wild habit seems broken up, for from stock as black as night I have obtained grapes as white as the Chasselas, delicate in texture and flavor. The best way is not to raise seeds promiscuously. I raised many hundred more seedlings than I had need to, and should have succeeded more rapidly if I had planted the seeds only of those grapes which showed the most marked change from the original type. The desire is not seed, but fruit; to ameliorate the harsh flavor, softening the pulp, making the fruit more edible. This is accomplished by putting the seed in a rich soil. The new conditions change the plant. Instead of the meadow or pasture where the wild parent grew with vigor, but coarse habits, the seedling revels in a congenial soil, and, stimulated, shows a change in habit. Departure from native type is a sign of improvement. In the seed-bed vines will be found short-jointed, smooth, solid, with prominent buds. These deserve special care; from them will be had vines with greater divergence from the original type, more certain of success. Barren vines usually have great luxuriance of growth. In the first year the seed-bed will be filled with these rampant and, to the novice, promising vines. My experience leads me to reject these, or, at least, plant them by themselves. Seeds continue to come up for even four years in succession; the best grapes come from these latter seedlings. Commence with seeds of chance or new varieties having vigor, earliness, and other qualities which are desirable in the offspring. Plant the grape whole, in rows, to facilitate weeding; the placenta-like substance in the whole grape nourishes the seed and promotes its power. The tender seedling should receive no check; shade it from the hot sun, and water it, if necessary, until it gets three or four rough leaves, after which it may be considered safe. When seedlings have grown one year in the seed-bed, with the aid of a fork draw out the plants with care, without breaking a single root or disturbing the level of the bed, and thereby burying the seeds that have not yet sprouted. The second year another crop of vines will come up; treat them in the same way, to make room for the third crop. These last I save with the utmost care, as these show the greatest improvement. The seedlings thus removed from the seed-bed should be put out in soil enriched with bone-dust, ashes, and gypsum. These fertilizers I consider essential to the grape. Stable manures give a luxuriant growth. I prefer mineral manures alone. Do not reject a vine too hastily, for the size and quality of fruit will improve for seven or eight years. I do not prune seedlings except to give them shape, but pinch back any rampant branch. Seedlings do not usually bear till the fifth or sixth year."

Such are the views of Mr. Bull, with which the experience of all must coincide, except in regard to the peculiarities of the extreme northeastern climate and soil, which differ from other parts of the Union. It is evident that we are just beginning at the foundation; that we are yet to get by this process grapes as hardy as they now are, as free from disease, and in the end as choice in pulp, flavor, and sweetness as we desire, and even superior to those of Europe. This, too, with good reason, as the thousands of European vines in European

nurseries, those vast regal or imperial collections of varieties, have but few that can claim other merits besides size and sweetness. Only a few of them are highly flavored, such as the Muscat of Alexandria, Black Hamburg, the Frontignan, and the Chasselas Musqué, and others similar to them, and kinds more durable in national and individual esteem have not been found than these. But our grapes are highly flavored, almost without exception. Indeed, that is often the fault with them; they are too decided in flavor to suit a taste accustomed to European varieties, and are therefore condemned by many, who seem never to dream why the Creator gave us such germs on which to found our beneficent labors; they are too acid, and this is a fault which the grape has in common with all wild fruits. The acid apple, almost inedible, is tamed by seeding into well-known kinds, many thousand seedling apple trees being required to get a Porter or a Newtown Pippin, or other superior kinds. In the course of a few years we are already reaching the same success in the grape which was but yesterday in the forest, unimproved since the world began until planted by art, either in the vine or seed. So that it may be true that no one who would improve grapes is more sure of his reward than the diligent, judicious seed planter. The varieties to be improved are numerous. There are not only the known and somewhat esteemed kinds, but there are sites where quite a number of kinds almost edible are found, as at Malden and Cohasset, Mass., in New Jersey, and elsewhere; as also places where a single plant is native. For example, it was only last autumn I saw a wild vine taken from a rocky glen. It is very minute in size, ripens early, is deliciously sweet, mild, but peculiar in flavor. Its faults are small size and such a deep blue-black that stains the mouth a purple, and it bears only when allowed to ramble freely. Now, could a seedling, large in size, the same in color, amenable to trellis culture, be had from it, a fine wine grape would result, with the richest color. Could another seedling be had, large in size, less in color, equally early, as sweet, and with the same flavor, it would be a valued table grape. This is a sample of what the whole country abounds with, being full of these germs of excellence given by a kind Providence, not to be wasted and despised because He who gave them did not see fit to complete them, but left that for us to do, presenting them at every man's door—a fact that the originator of the Concord, happily, did not overlook when, in the vicinity of his homestead, he sought the parent vine as the one most fitted to be matured there.

It were easy to name the defects to be avoided and the qualities to be sought in each of the varieties prominent before the public, but they will occur to any one competent to the task of improving patiently and systematically, for no improved plant or animal is obtained otherwise.

And the rule by which it is had is very simple on paper, but laboriously complex in the effort of good judgment in practice. What are improved sheep and cattle but the stock procured by taking the best animals to be had, and perpetuating their excellences and getting rid of their faults? The rule is simple: what has done the work? The good judgment of him who gave his life to it. The practice is laborious, and the same that is true of the development of animals is also true of the vine. We, therefore, hope that judicious, systematic seedling of the vines found at the very doors of every man, as well as those which he can get elsewhere, will be universally attempted, that from these sources, unfailing in variety as they are, and unsurpassed in the beginnings of excellence, may come supplies of even better grapes than the many deserving kinds we now possess.

In the artificial production of hybrids we have the second great source of improvement of American grapes. The natural production of hybrids probably rarely or never takes place, for on a grape flower no bee ever alights, save to rest accidentally, so that the bee-cross theory needs proof that it ever is effective in this case. And vines near each other seem not to commingle so as

to make crosses, though, perhaps, they do slightly modify each other. The seed planter raises "many hundreds" of seedling vines "to get one good one." One of our citizens claims that he raised "thousands" to get his favorite, "the rest being useless." But the greatest well-authenticated number of seeds of any one kind hybridized is not, perhaps, two or three hundred, and of these not one that survived the exposures of early life and grew up to prolific maturity either failed to bear or was a worthless grape. The hybridization of a single berry with three seeds has given three plants marked and valuable in their characters. So that the labor by the seedling plan is large, and by the other a very few seeds determines the result. Hybrids, too, are proven to be no more subject to mildew than the natives, another favorable fact; but the re-hybrids or second hybrids are liable to mildew, so far as the second crosses have been tried. Another remarkable fact is that hybrids, in the kinds that have been subjected to chemical analysis, have their acids wonderfully reduced from the excess of the American native to an approximation to the per cent. of acids in the foreign vines. All of which are very singular and happy effects, quite remarkable and indisputable.

The Agricultural division of the Patent Office employed the able services of Dr. Jackson as chemist for the analysis of grapes, with some of the clearest results obtained to that time, and thus settled the question as to what acid was in American grapes, showing that it was tartaric acid, and in as pure a state as in the European grape. The tartaric acid was in nearly every one of our natives in great excess over the normal demands for wine and for table uses of the grape. Dr. Jackson also ably settled the fact that sugar was deficient largely in our grapes.

Since that time but few, if any, analyses have been reported. It is desirable that all our known grapes be analyzed. D. M. Balch, of Salem, Massachusetts, a graduate of the Scientific School of Cambridge, Massachusetts, has the reputation of great accuracy in his chemical investigations. The following are extracts from an essay by him prepared for publication in the Essex County Institute Report of Massachusetts. He says:

"To answer the question which, if any, of the native grapes ordinarily ripening in this vicinity is best adapted to wine-making," (at Salem, Massachusetts, where he resides,) "I have the last autumn (1864) analyzed the fresh must of several varieties. I had also another object in view, namely, to ascertain if the table adapted to Oechsle's must scale by Gall, from numerous analyses of European musts in 1851–'52–'53, was applicable to the must of our native grapes.

"My method of analysis was as follows: The grapes were gathered when dry, pressed, and the juice strained through linen. The specific gravity of this clear must was taken by weight in a bottle with a perforated stopper. A portion of must was diluted with fifty times its bulk of water. The sugar contents were ascertained by Fehling's method.—(Annalen der Chemie Pharm., Bd. 72, S. 106.) This method is very accurate, if carefully performed. Finally, the free acid in a weighed portion was neutralized by a solution of caustic soda of such strength that 1 CC equalled .00825 grm. of tartaric acid, the result being considered satisfactory, with small inaccuracy. The results in percentage obtained are as follows:

Variety.	Time of gathering.	Specific gravity.	Sugar.	Acids.
Clinton	Sept. 26, 1864	1.0688	13.77	2.40
Alvey	Sept. 21, 1864	1.0640	10.37	2.60
*Alvey	Oct. 5, 1864	1.0734	14.70	2.02
Franklin	Sept. 5, 1864	....	8.77	......
Franklin	Sept. 21, 1864	1.0610	11.20	2.16
*Union Village	Oct. 5, 1864	1.0556	10.00	1.21
*Allen's Hybrid	Oct. 5, 1864	1.0780	16.20	.59
Adirondac	Oct. 5, 1864	1.0714	14.00	.28
Concord	Sept. 26, 1864	1.0615	11.83	.86
Hartford Prolific	Sept. 26, 1864	1.0721	15.01	.43
Delaware	Oct. 5, 1864	1.1021	20.63	.65
Delaware, (Salem, Massachusetts)	Oct. 5, 1864	1.0896	19.70	.70
Rogers Hybrid, (Norwich, Ct.,) No. 15	Sept. 5, 1864	....	9.20	......
Rogers Hybrid, No. 15	Sept. 26, 1864	1.0783	16.47	.66
*Rogers Hybrid, No. 15	Sept. 26, 1864	1.0839	17.90	.70
Rogers Hybrid, No. 4	Sept. 26, 1864	1.0749	15.46	.61
*Rogers Hybrid, No. 4	Oct. 5, 1864	1.0819	17.30	.65
Rogers Hybrid, No. 22	Sept. 26, 1864	1.0723	14.56	.76
*Rogers Hybrid, No. 22	Oct. 5, 1864	1.0796	16.70	.59
Rogers Hybrid, No. 3	Sept. 26, 1864	1.0734	14.70	.66
*Rogers Hybrid	Oct. 5, 1864	1.0749	15.30	.47
Rogers Hybrid, No. 19	Sept. 26, 1864	1.0680	13.65	.81
Rogers Hybrid, No. 1	Oct. 5, 1864	1.0665	12.60	.62
Rogers Hybrid, No. 9	Sept. 21, 1864	1.0680	13.41	.87
Rogers Hybrid, No. 9	Sept. 26, 1864	1.0742	13.00	.57
Rogers Hybrid, No. 33	Sept. 26, 1864	1.0572	11.70	1.01
Rogers Hybrid, No. 41	Sept. 26, 1864	1.0749	15.63	.76
Rogers Hybrid, No. 30	Oct. 5, 1864	1.0630	11.80	.84

"The sugar percentages marked * were not obtained by analysis, but are Dr. Gall's corresponding densities. From these analyses native grapes seem to be divided into three classes—

"1. Those in which the proportion of sugar and acid are well balanced, as Delaware and most of Rogers's Hybrids. These grapes should yield good wine.

"2. Those in which the acid is *deficient*.

"3. Those in which the excess of acid overpowers and renders the fruit nearly inedible, as the Clinton, Franklin, &c.

"The analyses also prove that Dr. Gall's table for Oechsle's must scale can be safely used in finding the saccharine contents of native must; the numbers obtained by analysis agreeing closely with the tabular amounts for corresponding densities.

"To produce a wine that shall keep, it is necessary that the must should contain at least 15 per cent. of sugar. In Germany the juice of the best grapes, which are the Reisling, in the most favorable seasons contains 24.28 per cent. of sugar and .65 of acid. This gives the most excellent wines, and is regarded as the normal standard, with which inferior musts are compared, and often made to coincide, as far as possible, by dilution and addition of sugar—a method of improving the juice of partially ripened grapes, by which, in bad seasons, total failures excepted, a wine can be made nearly equal to that of favorable years, due to Dr. Ludwig Gall, who has published a treatise on the subject, an abridged translation of which is in the Patent Office Agricultural Report of 1860.

"The value of the analysis of grape juice" shows the results "of various seasons, climate, soils, &c.

"The above analyses are imperfect, several prominent kinds having been omitted, but I hope to extend the collection at some future time.

"DECEMBER, 1864. D. M. BALCH."

Having received the above from the report about to be published, I have considered the results too important not to appear simultaneously in the report of the Agricultural Department. If there is no error in these analyses, they show, as did those of Dr. Jackson, that excess of tartaric acid is a fault to be corrected in every wildling; the nearer the vine being to the untutored wild vine, the greater, as a rule, the acid; that there are a few greatly changed in this respect, as the Concord, Hartford Prolific, and the Adirondac; that hybridization gives immediately the reduction of the acids to their proper degree; and that we have wine grapes, and what they are. I believe the best wine standard is fifteen degrees, in the must or juice, by Beaume's hydrometer, for the sugar; four pounds of acids in each thousand pounds of juice by weight, though six or even seven pounds of acid are admissible; or, as in the analysis, four to seven-tenths of one per cent. of acids; and one-third of the aroma that is in the Catawba grape, though twice that aroma, or one-half of that of the Catawba, is desirable. With these as standard rules, the artificial manufacture of wines is at once apparent to every one competent to make wine by the use of instruments. But to me it is a peculiar joy to see that hybridization and often seedling the vine gives us grapes out of our hyper-acid wild natives, at once just what the best chemists and wine-makers of both continents have declared to be the most desirable.

Now, wines excessively acid, corrected by large additions of sugar, become cordials, that any one familiar with our native wines immediately detects and is displeased with, no matter how sweet and pleasant they may be to those unaccustomed to taste our native juices. Best wines reduced to five-tenths of one per cent. of acid by the addition of sugared water, when the sugar by the degree of the hydrometer of Beaume does not exceed 15°, are so nearly natural that it requires a good wine expert to detect the sugar added to the wine; but the least additional quantity is at once detected. Wines can very easily be made without sugar from many of our native improved seedling vines, and especially from our hybrids, and such vines have a peculiar relish, greatly loved after the palate becomes accustomed to the absence of sugar and other articles, so often present in the wines imported, which we are taught to believe pure. "A sweet nectar" is the idea of wine derived from poetry, and from the high enthusiastic glow that travellers in rainbow colors throw over all they see and taste in Europe. But truth shows us that wines are not often sweet, nor have that "cream of every perfume in one delicious drop" the overwrought ecstatic imagination would have them possess. Yet a sober, hearty relish can be easily acquired for many of our native wines, far more pure and chaste and healthful, both for the table and the sick bedside, than any of foreign lands. This correction of American ideas of wine is in daily progress among us. Many of those who, five or ten years ago, never tasted a pure wine, now instantly detect the smallest mixture of sugar, brandy, or other impurity, even that necessary to raise the must to fifteen degrees of Beaume.

But native wines made of less than the above rule of sugar in the grape, though they would soon so please the consumer that he would use only wines made without sugar artificially added, are yet perishable; and the next art for our yet inexperienced wine-makers to learn is how to bottle early, for when once safely in the bottle they will keep, though perishable in the wood cask. And in this art, perhaps, more than others, do we need progress, namely, how to bottle at a few months' age safely, so that the bottle shall not explode, nor the individual character of each grape be lost. When that is done, we need but one more rule to be perfect in wine-making—and that is, that each man make his own wine; that is, that we seek not to blend the aromas and flavors into one common rule, but each make his own aroma and flavor, with no addition to the pure juice, but by mere manipulation only. And when that is done, the individual or the local vineyard brand becomes a mine of wealth.

The fact is, the native wines over most of our territory east of the Rocky mountains are more sure in the sites where they flourish than is the apple, peach, or pear, and far more sure than the grape in Germany. We lose by insects alone one-half of the apples that set on our trees; but who ever heard of a tenth of our grapes lost by insects? We lose often a third or half of our peaches by disease; yet if a few grapes rot or are mildewed in any one locality a host of declaimers publish the fact. There is no crop more sure than that of our grapes on every spot where they ought to be planted. And it will need not a dozen years, if we act wisely, to make our wines as surely as we do any other article we attempt to make by our own plans. In this light such analyses as those given above are invaluable, and when their number is so large as to give us light everywhere, the end we seek will be obtained. These analyses show us that a few days in fall add greatly to the specific gravity of most grapes. Inquiry into the cause of this specific gravity shows that it is largely the sugar in the grape, and that all the sugar is not made at the expense of the acid; for, in some cases at least, the acids also, though decreasing in relative proportions, yet increase. The few days also add aroma, flavor, and richness. But I cannot follow out this interesting subject fully. Having now closed what I have to say on these recent analyses, I resume the subject of hybrids. Rarely do I mean to assert a new idea such as the reduction of acids by hybridization without proof, and here it is given by the labor and pen of Mr. Balch.

Such results in hybridization are eminently encouraging, They lead us on rapidly and in the right way to attainments which we must make in order to have the best American grapes possible. To the most unbelieving they prove that the road to success lies open, and, so far as tried, few, if any, uncertainties attend it. It is because it has been so little examined that there is so little appreciation of the facility of this mode of improvement. The hybridist selects with care a female plant, and with equal care the male plant; studies the peculiarities of the vine flower, and operates with some delicacy, and is sure of results. We regret that this has so rarely been done, for we certainly have men capable of the operation, and we have mother vines which it is credible to believe are as good, if not better than any that have yet been used. We have had the Mammoth, of New England, the Delaware, Logan, Isabella, Perkins, Catawba, and a few others selected as the pistillate plants. Some of them are those that imperatively require to be tried; others are not the best. Not to be invidious, I name the Union Village, and its twin mate, which is larger, the Ontario, and the large but insipid blue wine grapes, as more likely to give us large, fine, black berries in ample-sized bunches; the Cattawissa, Hartford Prolific, and Miles as evidently disposed to give early grapes; the Taylor and others, white grapes, and so on for other colors and qualities. Yet we know of no one who has fully attempted these. We believe they are few who have yet tried to cross the pollen of any one kind on another, either native or foreign. The names known to me might easily be put on a signet ring, they are so very few in this laudable attempt to improve our grapes in this manner. Further on, we shall name crosses that are desirable to be had. Here we give the process of hybridization.

The grape opens its flower by a singular process, different from most other plants. We see the cherry, peach, and apple expand their petals, and retain them with their white or red colors several days; but the grape has its petals so united at the top of the flower that, as it opens, the petals are drawn off from their attachments and cast off in a sort of hood that falls to the ground, leaving the stamens and pistil naked. If there is any difficulty in making hybrids it is the removal of this hood, which should be done as soon as it is loose, and before it is naturally thrown off, and so to do it as not to jar down the pollen of the stamens on the top of the pistil, for I have often seen the pollen fall like a minute cascade of yellow particles, so heavy it is, and so direct and rapid its

fall. Notwithstanding this apparent difficulty, the hood can be easily removed by the use of forceps and scissors no more delicate, nor by a hand more steady, than is required by the surgeon in many cases daily demanding his skill. One circumstance I have not seen noticed; it is, that as soon as the hood of petals is off, the top of the pistil begins to be covered with a minute globe of transparent fluid, beautifully clear and highly refractive, glistening like a dew-drop on the top of the pistil. It takes usually from a few moments to an hour or two, according to the weather, for this minute globule to be perfected.

Now, no impregnation can take place unless this minute drop of fluid is secreted so far as to receive the pollen—that is, until it is almost or quite expanded to its full extent, which is rarely before the petal-hood has fallen, whether by art or nature. One more fact—the pollen falls on, adheres to, and sinks into this minute drop; and as soon as a sufficient quantity has thus been received by this drop of fluid it becomes turbid or milky, losing its transparency, and is drawn into certain pores or tubes, which are seen by their mouths as roughnesses on the stigma, which is the enlarged portion on the top of the pistil. Thus if the pollen is abundant, and the weather favorable, a few hours may suffice; if not, a day or two, or even the third day, may be required to complete the impregnation. After the third day I have not noticed the drops of fluid, even when the impregnation failed, the top of the pistil being dry. A rain may wash this drop off; and hence, though the season is otherwise favorable, there may be a large failure of grapes, though the drop is often renewed, at least once or twice after an accident.

Not to trace other interesting items here, it is seen that it is possible for us artificially to sprinkle this drop with pollen from another plant at the right moment, so that, although the stamens are not cut away, the hybridization is surely done, for we have merely to dust thoroughly this minute drop, and preoccupy its whole capacity, and the work is done; and in a few hours after the whole drop of fluid is drawn in, and the top of the pistil is dry even before natural impregnation would have been completed. So that I am convinced that the successful hybridist needs to study well this drop of clear fluid on the top of the pistil. It is only in case the weather forces out prematurely this secretion, or it comes out too tardily, or rain or other accident removes the drop, or it is dusted over early with its own pollen, that we are liable to fail in our hybrids. The operator must notice, too, whether it is secreted fully, else he may fail by being too early, or too late, when the drop is partially gone and a little milky with the absorbed pollen. Another circumstance to be noticed is that in a certain selected bunch of flowers all the flowers do not open the same day, and hence all the drops are not matured on the pistils at once. Early in the morning of the first day of the opening of the flowers, at or soon after daylight, a few of the petal-hoods fall and a few drops expand, but not many until the genial warmth of nine or ten o'clock is reached, which is the most favorable hour for the operation of hybridization. The operator then taking his stand close by the bunch of flowers, cuts away those that have opened and expanded the drop fully, while he watches for the loosening of a number of petal-hoods; these he immediately removes, either with fine forceps or the point of fine scissors, his eye closely watching whether any other bursts and lets fall a stream of pollen on the somewhat expanded globule. At this stage there is no fear of pollen dust; it falls, as I have said, heavily and quickly downwards. If the globule of the pistil has escaped this danger, the operator allows a moment to pass, that the others may expand or bend outward on their stems when he cuts them away. Thus he selects and operates on as many flowers as he desires, or which open that morning. He now watches the maturing expansion of the minute globules on the top of each pistil, and as soon as they have acquired a full roundness, curving to the smaller base by which they rest on the pistils, he

knows they are ready to receive the pollen artificially. On a favorable day this takes but a short time; in less favorable weather, hours may be needed, and in bad weather even a day or two. But when the right moment has arrived he dusts the globule freely, sprinkles it with an excess of pollen, then waits a few hours to see if the globule has lost its clearness, and is withdrawn down into the recess of the germ to perfect the seed of the future grape-vine. If so, then the hybridization is complete; if not, he must redust the globule every few hours while it is visible.

The seed planter needs his thousands of seeds, and these he must obtain; but the hybridist needs but a few seeds, each having acquired wonderful powers by the foreign pollen; thus he seeks but a few fertile pistils, and hence he should cut away the rest of the flowers that are unexpanded. The next morning he must examine the pistils again, and see if there are any globules yet clear and full, as sometimes they reappear the second day, and need another dusting with pollen. Such is my experience in the matter.

For dusting with pollen a small camel's-hair brush is recommended, but with no special directions how to use it. I suggest that the brush, about one-eighth of an inch in diameter, be dry and dipped in an abundance of pollen; thus the inside of the brush will appear yellow, being filled with it. Now hold the brush a quarter of an inch above the minute globule on the pistil, and with a knife-blade or other convenient instrument jar the brush with a number of gentle taps, causing the pollen to fall freely on the globule, an assistant catching the surplus pollen in a small paper box held below. A more perfect duster would be a tube with a small aperture at the lower end, out of which the pollen can be shaken by tapping. As to the age of the pollen we are credibly informed that, in the use of it in Europe for crosses, a month or two or more does not impair its virtue. My own practice has been to get within ten days, from some cold vinery, pollen in a small paper box, label it accurately, and keep it in a cool, moderately damp place until the native grape has become ready to open its flowers.

In addition to the ways of dusting the pistils, I have poured the pollen from the box over the globule and caught the surplus in the cover of the box, and then poured over the globule again into the bottom of the box, and so on. I have also wet the camel's-hair brush, and rubbed the globule harshly with the damp pollen-charged brush.

If some more accurate and scientific observer can tell us the best way of dusting the globule, I shall be much obliged. To the very delicate-handed operator I also suggest the bringing of a bunch of flowers, cut from the vine selected for staminate duty, and having prepared the native vine to receive the pollen, seize an anther from the flowers brought, with a delicate pair of forceps, and when almost in contact with the globule, directly over it, press the anther by closing the forceps. If the attempt be successful, a little fall of pollen will be had directly from it on the globule. Repeat it with several anthers, so that there be an excess of pollen.

I have been thus particular in the description of the process, because of the alleged frequency of failure, as if the process were so incumbered by natural obstacles as to be almost or quite impossible.

Next, let us ask what hybrids are desirable to produce? No more acceptable varieties of foreign grapes are available to fertilize our native species than the following well-tried kinds, though there are others not so easily to be had, that for magnificence of berry and bunch amply merit the judicious use of their pollen: I mean the Black Hamburg, the Chasselas Musqué, White or Gray Frontignan, and the Muscat of Alexandria. The first three of these are early, the last late. Could the powers of these be developed in our popular natives, an impetus untold would be given to our grape culture, for the fertilization of any of our choice kinds by them is absolutely sure to be attended with the

finest results to both berry, bunch, and flavor. The Black Hamburg is one of the hardiest foreign varieties, enduring well our severe cold in graperies with little protection, and it is large in bunch and berry, beautiful as a model, black, very delicate, tender, sweet, with a mild but peculiar aroma. Every nation admires it. The Chasselas Musqué also is vary hardy, can be repeatedly frozen hard in a grapery without injury during the winter; it is a large grape with a peculiar, high, musky flavor, and it is one of the earliest. It has but one fault, namely: if it be too freely watered during the ripening it cracks or has its berries split open. This fault cannot affect our tougher skinned natives. Its sweet deliciousness and lasting aroma make this one of the most desirable fertilizers. The Gray Frontignan is not as large, either in berry or in bunch, as the two preceding, but has a robust constitution, and every good quality to be transmitted to our natives, with a delicate flavor that must be tasted to be known. This is one of the best white foreign grapes. And to these we add the Muscat of Alexandria, a late grape, and, were it not for its lateness, unexceptionable. It is excellent in its size, habit, and flower. It needs caution in its use, and should be employed only on very early grapes.

To these four kinds, as male plants of hybrids, the Cannon Hall Muscat, Bowood Muscat, and others, might be added. Many of the extolled European kinds owe their reputation more to their excessively high treatment than their actual merits.

Still further, as a rule, beautiful clusters are a reasonable requisite. By this I mean, irrespective of edible or wine qualities, large, showy, compact, graceful shape of the bunch. Thus, could any of our large but straggling grapes have the compactness and neatness of the Northern Muscadine or Delaware, and still retain their size, there would be a gain. Could the Isabella have the size and shape of Seymour's Superb or the Cannon Hall Muscat, there would be a desirable advance. Choosing, then, any of our varieties having valuable traits as the pistillate plant, a large list of hybrids excelling the parent should result from fertilizing them with the four foreign varieties named; and many of the results should be in advance of any kinds now before the public. For example, by Black Hamburg cross upon Union Village, which originated in Ohio, at least a dozen large varieties of black grapes should be obtained, with large clusters, delightfully sweet, and with a hardiness to withstand our climate. By Black Hamburg on the Ontario should be had a still larger grape, though very similar to Union Village, with larger berries and more compact bunches, and equally as good. Hybrids of the Delaware and Chasselas Musqué should have two types, the red of the Delaware and the white of the Chasselas; and he who gets the twenty-five or fifty varieties of each will find them in every respect better than the Delaware, early enough to ripen in our northern States, and having beautiful and compact bunches. The score of valuable early hybrids by Black Hamburg on Hartford Prolific should retain the excellence of the Hartford, with expansion of both berry and bunch, and deriving sweetness from the Hamburg. The Gray Frontignan on the very early Perkins ought to be nearly or quite as early as the Perkins, and far more delicious as a table grape; and for wine, it should possess in richer degree the fascinating rose perfume that is found in well-made Perkins wine, without sugar; and the hybrids, or some of them, should be examples of beautiful light-colored tints. Gray Frontignan and Delaware should double in size the Delaware, and surpass that small grape in its bunches. The sugar grape of Cape Cod, Monument, Sandwich, and other places in Massachusetts, by either Chasselas Musqué or Gray Frontignan, should produce a white grape so far in advance of every white grape now in existence as an American grape that his name would be immortal who shall make the ten or twenty or more valuable varieties that surely would result from the cross. The White Clinton or White Delaware, both improper names, is a fine-looking little

white grape, utterly insipid and worthless, so far as I have ever seen it; but, being white, hardy, and vigorous, may possibly, by Chasselas Musqué or Gray Frontignan, gain in flavor, size, and sweetness, the result being a fortune to the successful operator. The Dracut Amber, a seedling of Asa Clement, is a very early red grape, with a peculiar aroma. Its good qualities are large size, vigorous growth, and high aroma. It is capable of vast improvement by hybridization. The Mahogany grape, of Malden, Massachusetts, introduced by G. W. Clark, is a better grape, and its rich color, by proper hybridization, will give us some of the richest reds we can probably produce in America, making large, beautiful berries and bunches, with Muscat flavors. The Crystal grape of the central portion of Connecticut has the fine qualities of size and beauty, that can be enriched by the delicate pulp and flavor of the European varieties, and well worth the trial to produce a hardy, early white American grape; for a *white grape*, though said by many to be constantly produced from the Isabella, Concord, and other varieties, is yet a desideratum that is unsupplied, the Rebecca and others to the contrary notwithstanding. The Lydia of Carpenter, of Kelly's island, is a promising grape, that deserves to be made more so by white foreign pollen. The little black Henshaw, of Martinsburg, Virginia, should have the wine grapes of Europe to enlarge its tiny berries and bunch, while it retains its rich red and purple, so deep as to be black in the berry. The so-called Oporto, laden with its vast excess of tartaric acid, inedible, with the faults of irregular bunch, and wanting in power to fully load the vine, needs the stimulus of Burgundy or other pollen, or that of the real Oporto, to give us wine. The larger berries of the summer grape families also offer good wine elements. One I know as "William's wine" has a large round berry in a small cluster at the end of a long stem, and occasionally, at the end of a long side-stem, a berry or two in place of a full shoulder. Now, if hybridization has proven anything as to these skeleton bunches in the "*Labrusca æstivalis*" and other families of American grapes, it is that it not only reduces the acids in them and modifies the flavor, but also clothes with berries these rudimental skeletons of large bunches, remarkable as these changes are.

William's wine grape has the fox grape perfume, mingled with that of a rose, and hence has better elements than many of this large class, of which I have seen some forty or more that I cannot in this brief article enumerate. Of them I have seen more than one with a skeleton bunch and shoulder, berry as large as the Black Hamburg, ripening where the Delaware will not, on the bleakest, coldest hill-tops, mild in flavor, soft in pulp, being in every way germs of magnificent grapes, when under the hands of the hybridist. The Clinton, that hardy little wine grape, by Black Hamburg or other foreign pollen, should have its fifteen or eighteen pounds of acids in each 1,000 lbs. greatly reduced in order to make good wine; and till it is done, the best wine cannot be made from it. The Concord is an established table grape, and its wine among the prime American qualities; its large bunch, by Black Hamburg, should be larger still, and its flavor doubled; by Chasselas Musqué it would become delicate; by Gray Frontignan still better; and if Muscat of Alexandria or Cannon Hall Muscat will give us an early hardy grape, it will be one of the finest possible. The Scuppernong is, like many others, excessive in its acids, having the enormous amount of seventeen pounds of tartaric acid in a thousand of its juice. Its acids should be only five to seven pounds in a thousand; hence its radical cure is only by hybridization.

Rebecca is a fine grape on a poor, spiritless vine. It needs the new life of hybridization by white pollen. By Chasselas Musqué or Gray Frontignan, it ought to assume a deserved place in every vineyard. Mr. Campbell, of Ohio, has already most successfully demonstrated a few of the hybrids of Logan, Delaware, and Union Village. But, interesting as it would be to follow out

the capabilities of fifty or a hundred other of our native grapes, the want of space compels me to leave half finished what I would say on this point. I trust, however, enough has been written to show what the unnamed varieties can be made to produce.

Next, let us inquire what has been done? Perhaps no man stands more highly before the public, in this respect, than Edward S. Rogers, esq., of Salem, Massachusetts. The distrust with which his grapes were at first received is giving way daily before their proven value, and he will, in the future history of American grapes, stand as the first successful hybridist of one of our native grapes. He took the Mammoth or Sage grape for the pistillate vine. This is said to be a vigorous grower, clambering over rocks and trees in a wild state in eastern New England. It bears bunches, oval-shaped, on a stout stem, with three to six berries in a bunch, but these few berries very large. So that little else except hardiness, earliness, and size exist in it. It has much acidity to condemn it. It is considered a fair representation of the Mammoth or Sage, leaf, stem, berry, and bunch. It is thus described by one familiar with it:

"It is much like most of the wild Fox grapes of this vicinity, but the berries are much larger, light chestnut or mahogany color, and they have a flattened or compressed shape, instead of being round, frequently an inch in diameter. The bunch is small, with three to six berries in a round, ball-like cluster, with sometimes a side stem with one berry at the end of it for a shoulder. The stem of the bunch is not very long. The leaves usually are 'entire,' with a short pointed termination at the end of the midrib, and two other points of the other divisions into which all American leaves are divided, making always either plainly, or in the rudimental state, five lobes. Thus the leaves are not much lobed, scarcely toothed, and have a rusty, woolly appearance. The young wood, last season's growth, is hard and wiry, and covered with bristles. The grape itself is sweet, but has a hard pulp, that some compare to a piece of India-rubber when eating it. It is early, and perfectly hardy, as much so as any wild grape in this vicinity."

Mr. Rogers fertilized this with Black Hamburg pollen, and a few seeds with Golden or White Chasselas. The results are among the most remarkable in the whole history of American grapes. The broad, nearly square coarse leaf of the Mammoth, without distinct lobes, has become more acuminate, and with lobed leaves at the base of each leader, and the coarse wild leaf assumes a more delicate attenuation; yet, with the native hardness perfectly retained, large, finely moulded, and shouldered bunches, with two and only two types of color and several flavors, have been produced in the hybrids. While seedlings of the Sage or Mammoth grape have so far proved worthless in the hands of a dozen men skilled in raising seedlings, and unable to advance on the parent plant, of the forty-five seedlings, or about that number, that survived of the hybrids, not one was either barren or useless, but each one improved. It is extraordinary what variety and excellence have been obtained. About one hundred and fifty seeds were hybridized by the Black Hamburg, and a few more by the Golden Chasselas. Of these, only some forty-five were ultimately saved and grew up to bearing. We have fruited quite a number, and several times seen and eaten the fruit of others, and have for several years been satisfied that ignorance of the grapes themselves, as well as the want of time and inexperience with them—it being not yet ten years since the first one was fruited—alone have prevented their just appreciation. In the end, it will be found that for wine they already have no equal, and for table grapes are worthy of universal attention; and the experience of every year shows the certainty with which they are gaining esteem everywhere.

Mr. Rogers's own language is:

"When I commenced experimenting I had no knowledge of any one who had raised grapes by this process, though I had heard of flowers, pears, &c., and I had attempted crosses of pears. Reading articles in the London Horticulturist, it occurred to me that I could get a new grape by this process; combining the qualities needed for open culture, it would be more valuable than any other fruit. Accordingly, in the spring of 1851, searching for a parent

vine, I selected a Labrusca, called the 'Mammoth,' for the native mother plant: this a large, brownish red or amber grape, one of the earliest and largest I could find. I chose as the staminate or foreign parent the Black Hamburg and White or Golden Chasselas, two of the hardiest foreign varieties, growing in a cold grapery near by. When the Mammoth was ready, several clusters were chosen. The petals, which were at the top, were cut away, and the stamens. Then the pistil of each blossom was touched with pollen, the vines in the grapery being retarded for the purpose, and the bunches protected by tying over them little bags of fine cotton cloth, enclosing in each bag a flower cluster, the same kind used as a fertilizer. The bags were opened the next day and the pistils retouched, after which the bags were left unopened a number of days. When opened, the berries were nearly all set. As soon as the grapes were ripe, the seeds were taken out and planted at once in a piece of ground protected by boards, in rows six inches apart, a few leaves being put over them as cold weather came on, as a winter protection.

"In the spring the covering was removed, and nearly every seed vegetated, coming up regularly as planted. But about fifty of one hundred and fifty plants were raised, the others having been destroyed by the cut-worm soon after coming up. In the fall most of them were a foot or more high, and were again protected for the winter by leaves and boards. The following spring there were many of them transplanted. A few vines from the Golden Chasselas were kept by themselves; the remainder, by the Black Hamburg cross, were put by themselves, and each plant staked and numbered, the final numbering being from one to forty-five.

"The foliage of the young plants early showing plainly the foreign intermixture, they were protected each winter, and in 1856 began to show fruit, and every one since has proved fruitful; in the fruit showing that they partook of the foreign elements, in the intermixture of the two species, combining the desired qualities, having large clusters, and much of the delicate flavor of the foreign sorts, with the earliness and hardiness of the native. The vines are even more vigorous than the parents, and more exempt from disease, and more hardy than most out-door varieties."

Having seen, eaten, and examined very many of these forty-five kinds, I can attest that what Mr. Rogers says above is true. As to vigor, the vine on the land of Mr. Harrington, who lives a short distance from Mr. Rogers, in Salem, is ample proof.

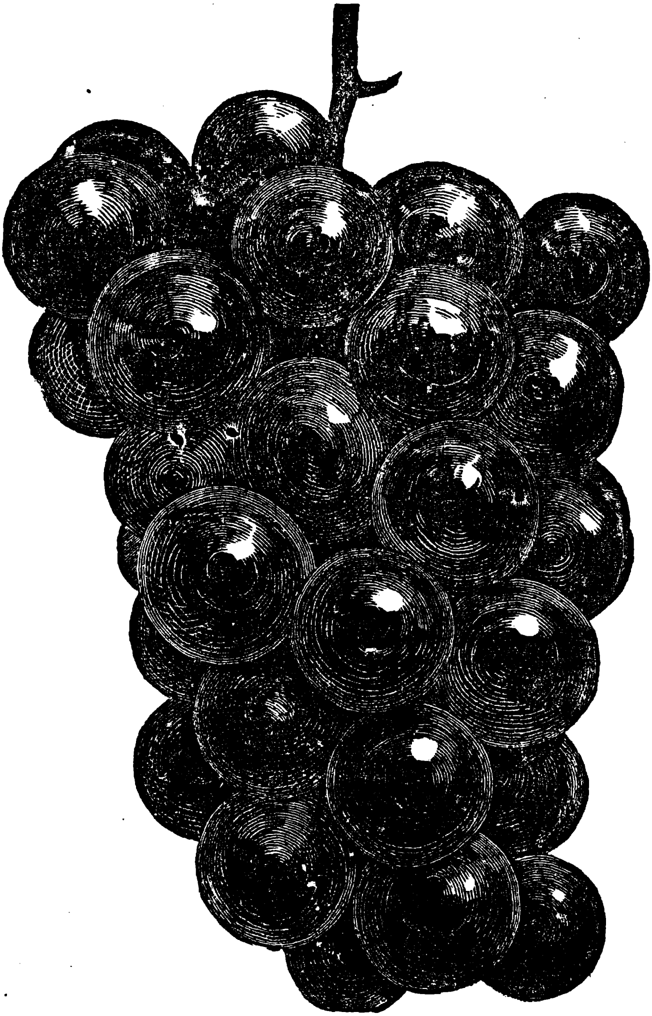
"Mr. Harrington's vine was set when small, six inches or a foot high, five years ago last spring, in the common soil of his garden, which is rather light and well drained, well cultivated, but with no prepared border; it is near to, and runs on, a fence about eight feet high, with a trellis affixed to it. The second season it bore a few bunches; the third season a fine crop; the fourth season Mr. Wilder told Mr. H. that he would ruin his vine by letting it bear as much when so young, but, to their surprise, it came out the next year with a larger crop, having between eight and nine hundred bunches, which were ripened and picked before frost; and this season, the 6th, it had fully as many or more still, continuing to make strong wood, and the trellis is full from top to bottom, the vine covering about seventy-five feet in length and ten in height."

Such is the remarkable effect of foreign pollen on an almost useless native vine, as it appears in Rogers's No. 15, a cut of which is here given, showing the actual size of this grape and its bunches.

Mr. Rogers's hybrids are all of two classes: 1st, the red or amber grapes, that follow in color the native vine, but with improved flavors; and 2d, the black grapes, that follow in color the Black Hamburg. The Chasselas crosses are all or mostly red. No. 1 is a late grape, and on that account is by some called white because it does not fully ripen; but when the locality or season fully ripens it, it is a light amber. Probably no grape equals this for champagne or sparkling wine. No. 4 is a black grape, as are Nos. 19, 23, 26, 33, 34, 36, 43, &c., which are excellent for the table and for wine. The red grapes are Nos. 1, 3, 5, 7, 9, 13, 15, 24, 25, 28, 30, 38, 41, 42, &c., of which Nos. 9 and 15 are much admired for wine and the table. Indeed, I do not know of a single number that is devoid of merit. Having made wine of quite a number of them,

I am aware of what I say when I commend these large and prolific vines as especially wine grapes; and for table grapes I also commend them.

For the want of space I omit the important subject of the re-hybrids made by Mr. Rogers—that is, those hybrids which he has re-crossed with foreign pollen. Mr. Rogers seems to think them too tender and liable to mildew. But as the writer lives where mildew goes unnamed and unheeded from year to year, the vine being less liable to disease or failure of its crop than the apple tree, though that is a fine fruit in his region, he believes that there are sites where the second hybrids will flourish in the open air with their delicate flavors and fine berries and bunches. I here introduce the No. 4 of Mr. Rogers's first hybrids, a fine, large grape, the cut of which was made from the exact shape and size of a bunch raised by Mr. Wilder. Larger and shouldered bunches have since been produced on older vines.



The next example of successful hybridization is that of George W. Campbell, esq., of Delaware, Ohio. In the report of the Agricultural Department

for 1862 will be found a valuable article by this gentleman, giving an account of the hybrids and crosses he has made, certainly with encouraging results. He says: "Contrary to the opinion of many, I have succeeded, with others, in demonstrating that the difficulties in the way of hybridization are not impossibilities, and may be overcome, and cross-breeds and hybrids produced at will, and with unerring certainty, between the differing varieties of natives, or between native and foreign varieties. Grapes recommended by the American Pomological Society as promising are Herbemont, Logan, Rebecca, and Union Village. I have used the Logan as a pistillate for its earliness, hardiness, health, and vigorous growth, relying on the staminate parents for improvement. I crossed Logan with Delaware, and Delaware with a variety believed to be the Ferrar or Black Portugal, with a cherry-like flavor and enormous bunches, and Logan with White Frontignan, and in one berry with Chasselas Musqué." The result has been the production of "compact bunches upon varieties that never set their fruit naturally. The seed was carefully saved and labelled, and planted in the spring in the smallest-sized pots, one seed in each. The greater number vegetated, each cross with strongly marked features. But few have produced fruit as yet. I do not consider them as sufficiently developed to warrant confident assertions." A reasoning and an attempt that he seems to have made with a very commendable motive, for he says.: "Very many persons prefer the sprightly, refreshing vinous flavor of the Delaware to that finest exotic raised under glass; and it is true that a grape with the fine qualities of the Delaware and the size of the Black Hamburg would be an acquisition of almost incalculable value." Mr. Campbell describes as very good and promising his cross of Delaware on Logan, ripening early, and flavor "intermediate." His Black Portugal on Delaware is a very peculiar hybrid, and "promising;" and also the result of his one berry of Logan, fertilized by Chasselas Musqué, as "vinous, very rich, very early." He then says: "I have White Frontignan on Delaware, Catawba on Logan, Delaware and Concord." It has been asserted that hybridized grapes would produce only infertile seed. This is erroneous, for I have plants from Allen's and Rogers's hybrids which have vegetated as easily and surely as others. "I have the present season re-hybridized several of Rogers's hybrids with Delaware, Black Hamburg, White Frontignan, Chasselas of Fontainebleau; and the Creveling with the same foreign varieties." There is no room further to trace these experiments, or report the few others that have come to my knowledge, and I shall not take up the time of the reader with my own experiments on Isabella, Ontario, Union Village, Perkins, Taylor's, Louisa, and others.

When these practical facts in reference to hybrids shall be fully summed up, and all that has been done or may be accomplished shall be fully told by some one competent to the task, the array will be well worth consideration. But I would be doing great injustice to my ideas on the subject, did I not notice as distinct in its classification, and high in its hopeful results, the making of cross-breeds of our natives. By this term I draw a just line of distinction. A hybrid is not merely, in the most exact language, a mixture of foreign pollen with the vitality of a native germ, or native pollen infused on a foreign pistil, but is also possible with our own species; thus the Mammoth of the Labrusca on the Vitis Odorata; Odoratissima is a hybrid also. Yet in common language we use the word cross between natives, and by hybrids we mean the foreign on the natives, and it is this latter meaning that I now attach to it. However, I can only invite our amateurs and professional grape culturists to the work of cross-breeding our grapes; for example, the persevering use of Delaware upon Isabella. If one fertilization of the Isabella will not add flavor to the seedling, let the second or third be made, until a large, mild, sweet, early grape results. I can conceive of a grape large as the Isabella, compact as the Delaware, and with a rich mahogany color, semi-translucent, yet sweet in pulp, and in flavor

as delightful as the Delaware now is; so, too, the Delaware on the Ontario, perhaps not at once, yet in the final end would obtain the size of the Ontario and the early habit of the Delaware, with the best of qualities of both. And so one could draw the picture of Delaware on Canadian Chief, Delaware on Louisa, Delaware on Miles and Hartford Prolific, and other fine and early grapes; and in like manner of any and all our well-known grapes on each other. Another idea is *cross-breeds sought through several changes*. Thus Ontario, which I regard as more hardy and better than Union Village, shall be first crossed by the pollen of the Delaware, and at least fifteen cross-bred plants be thus obtained, and then these shall be crossed by Louisa, which is an early and sweet choice seedling of the Isabella, and at least fifteen cross-bred vines of this cross should be obtained, seeking in them fine pulp, sweetness, and earliness, and these Louisa cross-breds with the Delaware shall in the third cross-breds receive the pollen of the Ontario, and the fourth generation be by the Delaware again, and the fifth and sixth be crossed on interbreds of the best of the crosses already obtained; and, if necessary, this repeated until a type is obtained of the sought excellence, earliness, and flavor. As another example, White Clinton or White Delaware—I mean the glabrous little white grape-vine of that name, not the hybrid of Mr. Campbell, crossed on the Rebecca, and in an inbred with the Lydia of Mr. Carpenter, of Kelly's island, or the inbred of Perkins and Ontario with Miles. The Concord fertilized in and by Ontario, with Rebecca for a corrective strain. Miles's Northern Muscadine and Clinton is another out of a large number that could be named.

And of the quadruple crosses, I name a cross of Miles on Hartford Prolific to be in and inbred to its best type, and Hartford Prolific on Concord to its best type, and the cross then of the best issue of these two; in the mean time inbreeding Hartford Prolific and Louisa, and also Louisa and Ontario, and then crossing the finest issues of these two; and for the last cross the crossing and in and inbreeding of the best of each of the twin results just named.

Before closing these remarks, I must name at least one other principle or rule. As a skilful physician, by the close watch of one or two cases of a certain disease, knows the form of the epidemic, or a surgeon gets the type of certain wounds by the case of a soldier or two, so we do now anticipate that we detect in our hybrids made by foreign pollen on our natives certain defects which are inherent in the method. Therefore, it would be well that we proceed and hybridize the foreign varieties with the native pollens which I have named. The first generation would doubtless be too tender for out-door culture, though with a fair chance of exceptional instances of hardihood for certain favored sites.

But the pollen of the same or other native varieties on the first re-hybrids would be hardy enough to endure our climate; that is, we do not take the foreign vine and add that to our untamed robust maiden vines, but we take our unspotted pollen, that has had no civilized refinements for its whole ancestry, and infuse its vigor on the weakened constitution of the foreign, until it is able to endure our climate. Thus we shall hybridize the Black Hamburg with Miles, our earliest grape, for a large early black hybrid; West St. Peter's with Delaware, Grizzly Frontignan with White Clinton, and Cannon Hall Muscat with Hartford Prolific, Bowood Muscat with Concord, and so on of other sorts.

I should have mentioned in its proper place, that, as the hybrids of Messrs. Rogers and Campbell and others are most of them hardy and early, and some of them have the finest strains of juice that can be drawn from European vines in making crosses, a very desirable series of vines can be obtained by using them as the staminate for any of our early grapes. Thus: Rogers No. 15 for Ontario; Rogers No. 3 for Hartford Prolific; Rogers No. 9 for Rebecca; Rogers No. 4 for Adirondac; Campbell No. 4 or Chasselas Musqué on Logan for Concord; Campbell's White Delaware Hybrid for Rebecca; Rogers 15 for

Ionia, &c., &c. Thus we should have a strong bias or strain of juice of foreign pollen, with the stronger still of the native; and often the further advantage of two natives in the cross-breds. Certainly there are in the scope of such varieties improved flavors and sizes well worth attention.

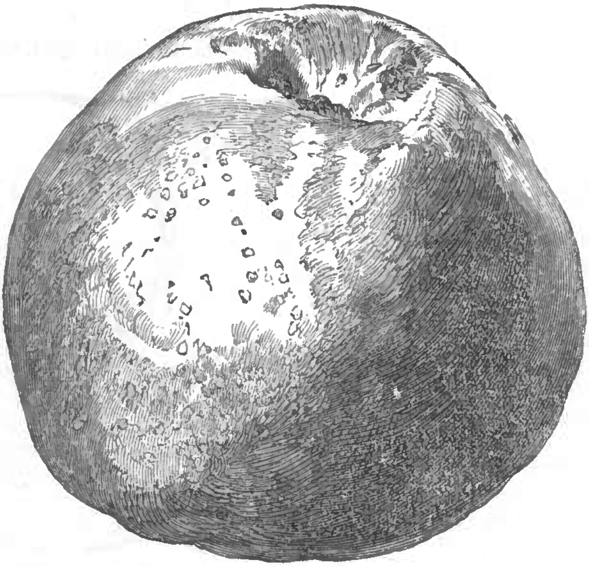
And the better idea that grows out of it, that as in sheep-breeding we select size and vigor, and cross to obtain flesh and fineness of wool, so in the grape we select, for example, a native with size and hardiness—the Ontario, for example—and cross to obtain flavor and edible qualities. I mention the Ontario, not always the best that could be named, but more clearly to distinguish what I am to say from what has been said. And then on the Ontario as a pistillate we use the staminate, Rogers's Hybrid No. 15, for its large bunch and berry and its semi-Frontignan flavor; and we intensify the flavor of this by using on the offspring of the Ontario and Rogers No. 15 the Grizzly Frontignan; and as in the same general class, for the third issue we use Ionia; and if we get no favorable result, we introduce a strain from the Adirondac and correct the issue by the Ontario or Rogers No. 15, again used on them, until we get a type firmly fixed in the new resultant grape; or, using the Ionia for a basis, we make a hybrid by Grizzly Frontignan, and then correct the issue by Rogers No. 15, with a strain from the Ontario. I am persuaded that by such plans, a large number of which could be named, there would be had beauty of bunch and size of berry and flavor not to be excelled. With these broad fields, not yet trodden by man, vast as are the prairies of the west in boundless extent, comes in the yet more illimitable expanse of systematic seeding of all these crosses and hybrids. This noble work invites the effort of every well-wisher to our future grape history, both for his own good and for that of the great national interests at stake in these desirable results.

When the day shall come that every one who can shall propagate by means of the elements thus briefly hinted, then we shall be on the road that will open avenues of success, by changes that shall break up the wildness and stubborn habits of our vines, develop their great capacities of hardihood and flavor, and give to our tables mild, sweet, and yet richly perfumed and delicately flavored grapes, and produce wine that shall know no equal on the face of the whole earth.

The changes and improvements of the past few years in the strawberry, the older and better known development of the pear, are but samples of the richer future of the grape; and the means are the same, only the application varies; the time necessary to be occupied is longer, but the happy, fruitful reward no less sure.

If by this article I have persuaded one amateur or professional man to enter the vast fields of seedlings, large enough to occupy thousands of willing hands, or the equally great expanses of hybrids, I shall be satisfied; for no one individual, no matter how favorably he may be situated, can in a lifetime do little more than make a beginning in such a great and noble work.

PLATE 1.



RED CANADA.

POPULAR VARIETIES OF HARDY FRUITS.

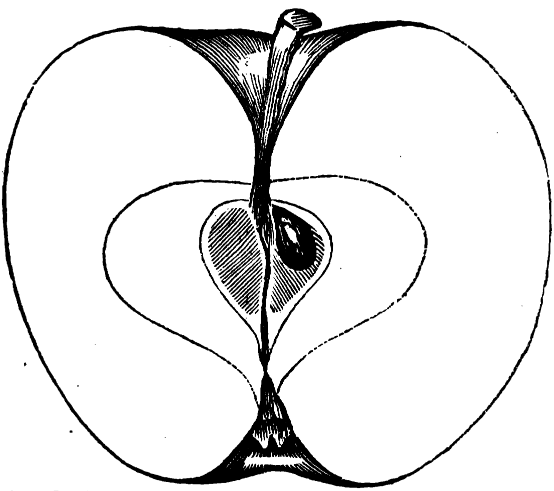
BY F. R. ELLIOTT, CLEVELAND, OHIO.

THE following is a continuation of articles descriptive of fruits published in the reports of the Department of Agriculture for 1862 and 1863:

APPLES.

RED CANADA.

Synonymes.—Nonsuch, Old Nonsuch, Richfield Nonsuch, Steele's Red Winter.



Fruit.—Size, medium; form, roundish conical, flattened at the base or stem end; skin, generally smooth, thin, and tender; color, rich clear yellow ground, mostly overspread with two shades of light and dark rich red, the red fully intermingled, occasionally almost striped, many small and light gray dots that at first sight present the appearance as of a somewhat rough exterior; stem varying from short and stout to slender and long; cavity deep and regular, with a touch of light russet; calyx small, closed; basin open, of moderate depth, and slightly corrugated or furrowed; flesh, yellowish white, crisp, tender, juicy, sprightly, sub-acid, aromatic; core small, compact; seeds ovate pyriform. Season, January to April.

As a table or market fruit it has few superiors; its quality ranking as "best," while its uniform size and carrying qualities render it always in demand by dealers.

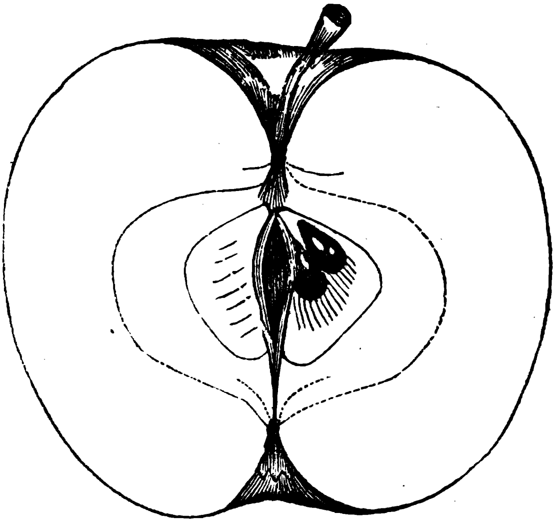
Tree.—While young, of slow and rather slender growth, forming, however, a wood of great firmness, that endures successfully extreme changes of temperature, shoots diverging, with wavy leaves. It requires a strong, rich soil to produce its best quality of fruit, but is good in all soils, and uniformly productive. In the northwestern parts of our States it is largely planted and successful. Origin probably Massachusetts.

WESTFIELD SEEK-NO-FURTHER.

Synonymes.—Seek-no further, Red Winter Pearmain, Connecticut Seek-no-further.

Fruit.—Size, medium; form, regular roundish conical, broad at base; color, generally a light yellow ground, with the sunny sides striped and splashed with red; small russet dots, surrounded with shades of a light russet yellow; there is often considerable russet around both stem and calyx; stem, long and slen-

der; cavity, open, regular; calyx, usually small, and generally closed, or nearly so; it is, however, sometimes partially open, and always with short segments; basin, regular in form, and of moderate depth; flesh, yellowish, tender, sub-acid, with a pleasant pearmain aroma; core, medium; seeds, ovate. Season, November to February.



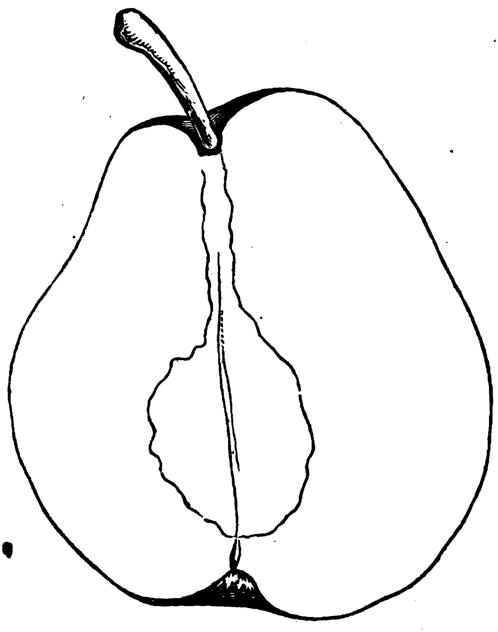
As a winter variety, this is valuable in our northern sections, but south and southwest it matures so early as to become almost a fall apple.

Soils have also much to do with the general appearance and quality of this fruit. For instance, in light, rich, sandy soils at the north it has very little of the russet character, but the red prevails and becomes quite clear. In alluvial soils, and south, it has often so much russet as to appear almost bronzed.

Tree.—Upright, spreading in general form; a medium but healthy grower, with moderate sized twigs and serrated leaves. An old and popular variety, originating in Connecticut. Productive.

PEARS.

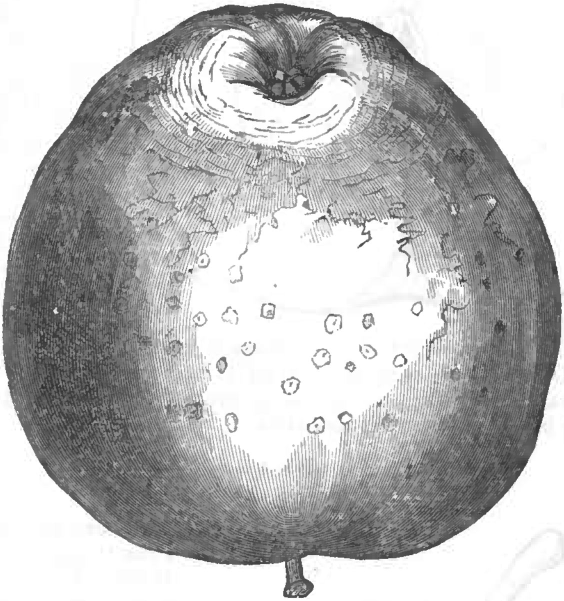
DOYENNÉ GRAY.



Synonymes.—Gray Butter Pear, Gray St. Michael, Gray Deans, Doyenné Gris, Red Doyenné, St. Michael Doré, Doyenné d'Automne, Doyenné Galeux.

Fruit.—Size, medium; form, roundish, obovate, or obtuse pyriform, usually a little more round than the White Doyenné; color yellowish, mostly overspread with a lively cinnamon russet, occasionally a little muddy in the sun; skin smooth; stem nearly three-fourths of an inch long, curved, smallest next the fruit, and planted in a narrow, rather deep, and abrupt cavity; calyx small, closed; basin shallow, smooth; flesh white, fine-grained, melting, buttery, and rich. Season, October.

This pear much resembles the White Doyenné in quality, but it keeps better, and many think

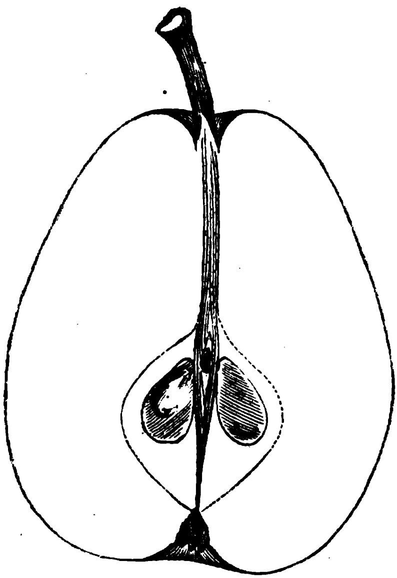


WESTFIELD SEEKNOFURTHER.

it less disposed to crack. It may be well here to say that trees of this variety, whose fruit has cracked for years, have been washed with a solution of sulphate of iron, and thereafter produced fair and perfect fruit. How generally successful such process may prove remains to be seen, but it cannot do harm, and may prove a specific remedy to what is known as cracking blight in pear fruit.

Tree.—Healthy, upright grower, with grayish brown shoots, succeeding equally well when worked on quince as on pear roots. Foreign origin.

WASHINGTON.



Synonyme—Robertson.

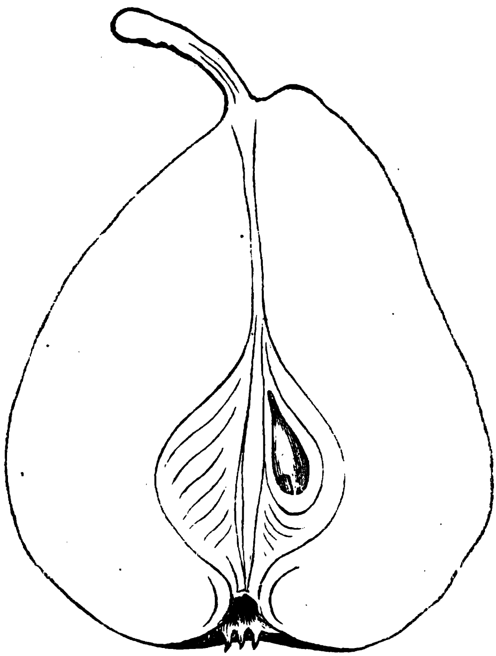
Fruit.—Size, medium; form, roundish ovate, or ovate pyriform; color, lemon yellow, tinged in the sun with red and reddish russet, and near the stem there are often patches of clear russet; stem about one inch long, inserted in a narrow cavity, sometimes almost obsolete, where there is a fleshy lip one side; calyx small, partially closed, and with long, pointed segments; basin round, regular; core rather small, and placed nearest the apex end; seeds blackish, obovate pyriform; flesh white, juicy, almost melting, sweet, delicious. Season, September.

Tree.—Of a healthy, moderate growth, with slender diverging reddish brown shoots. Originated in Delaware. A regular annual bearer, succeeding well on pear or quince roots. Altogether this is one of our most attractive and distinct native pears.

JALOUSIE DE FONTENAY VENDÉE.

Fruit.—Size, medium or above; form, varying from ovate pyriform to obtuse pyriform; color, dull yellow, with a brownish red cheek, and patches and dots of russet, often the russet covering one-half the surface; stem, varying in length.

usually set without depression, often obliquely, with a fleshy ridge or lip at side; calyx, with long segments half open; basin shallow; core, medium or



small; seeds long, ovate; flesh white, buttery, melting, juicy, sweet, aromatic. Season, last of September and early in October.

This is a variety that will rarely fail to give satisfaction in every respect, as it is delicious in eating, a fine grower, and great bearer. It should not be confounded with "Jalousie," an old third-rate variety.

Tree.—Upright, fine grower, with brownish yellow shoots, comes early into bearing on the pear root, but on the quince root inclined to overbear, and needs thinning out. Foreign origin.

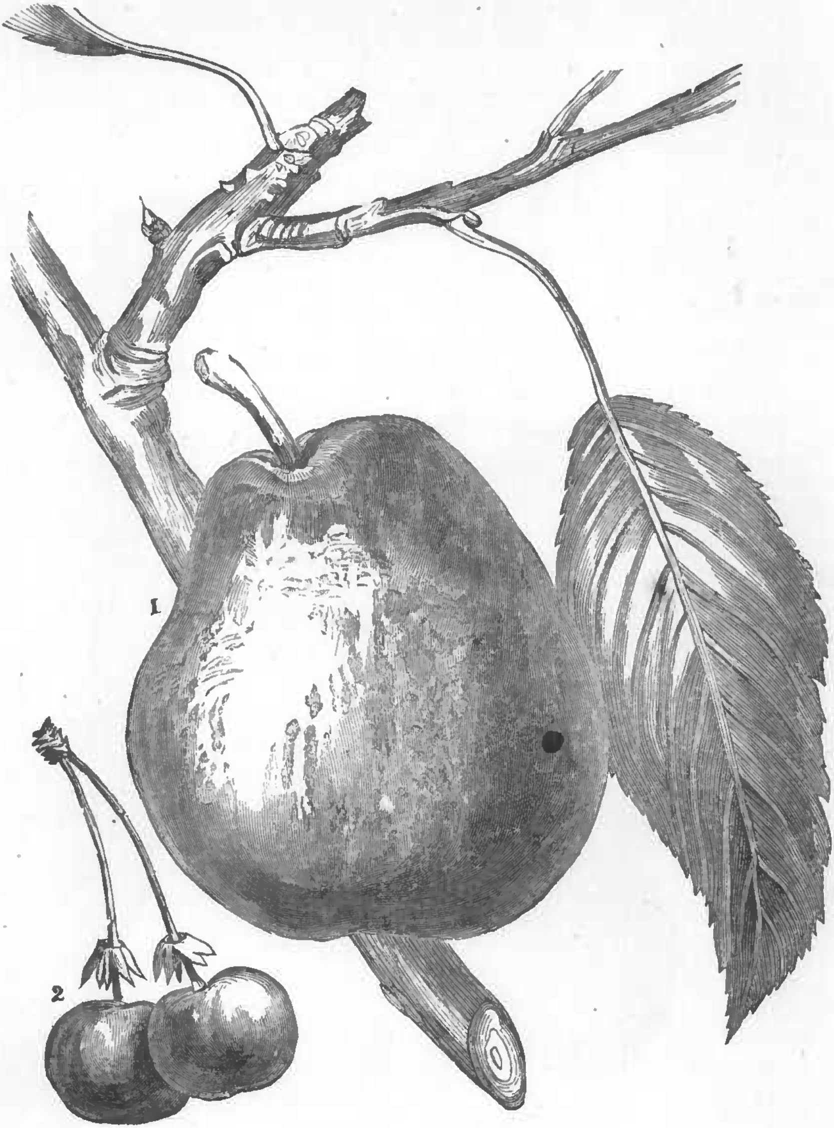
QUINCES.

ORANGE QUINCE.

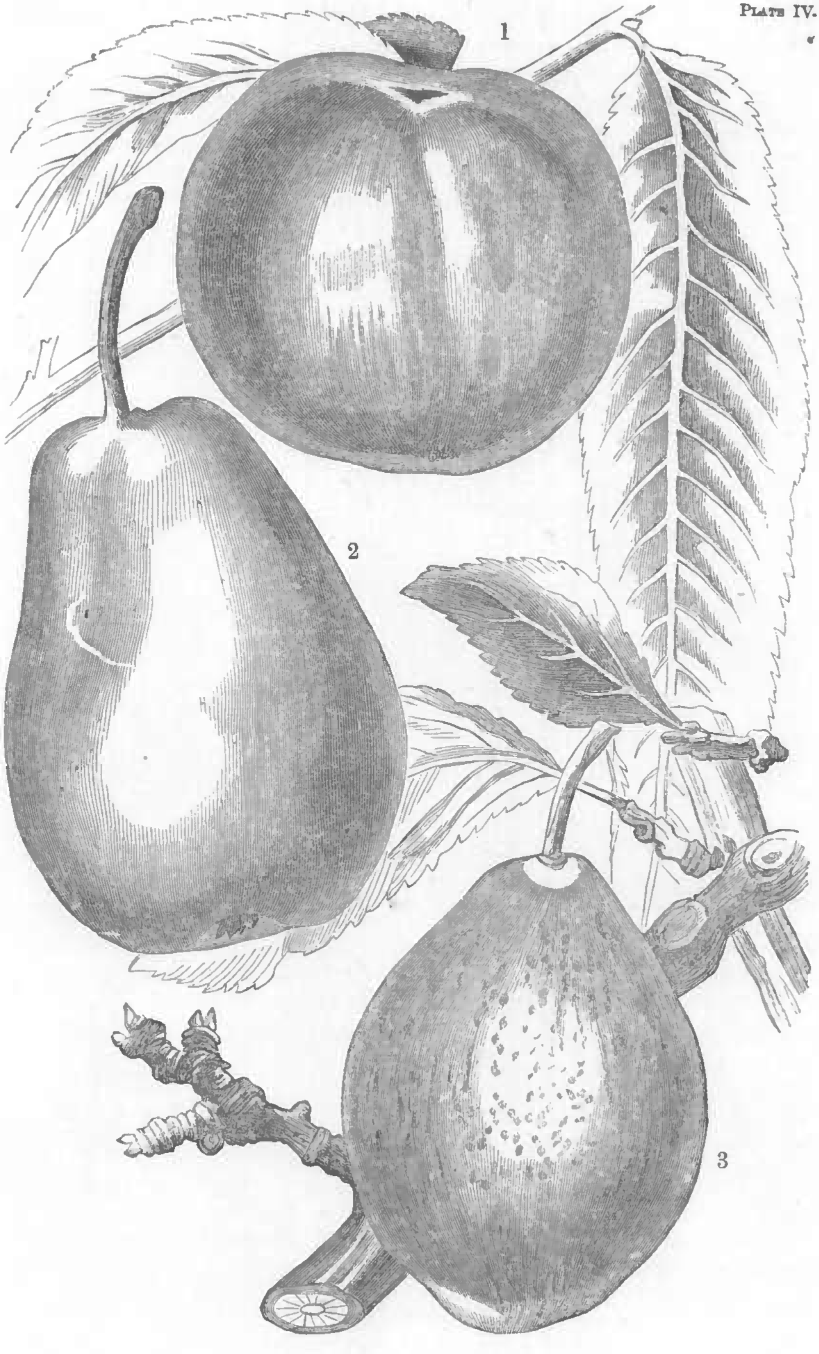
Synonymes.—Apple quince, apple-shaped quince.

Fruit.—Size, large to very large; form, ovate, obtuse, pyriform, varying to obovate conical; color, when fully ripe, a rich, clear, golden yellow; skin, smooth, with a fine delicate whitish bloom; stem, usually in a slight depression; core large, and placed nearest the blossom or calyx end; seeds, reddish brown. Season, last of October and November.

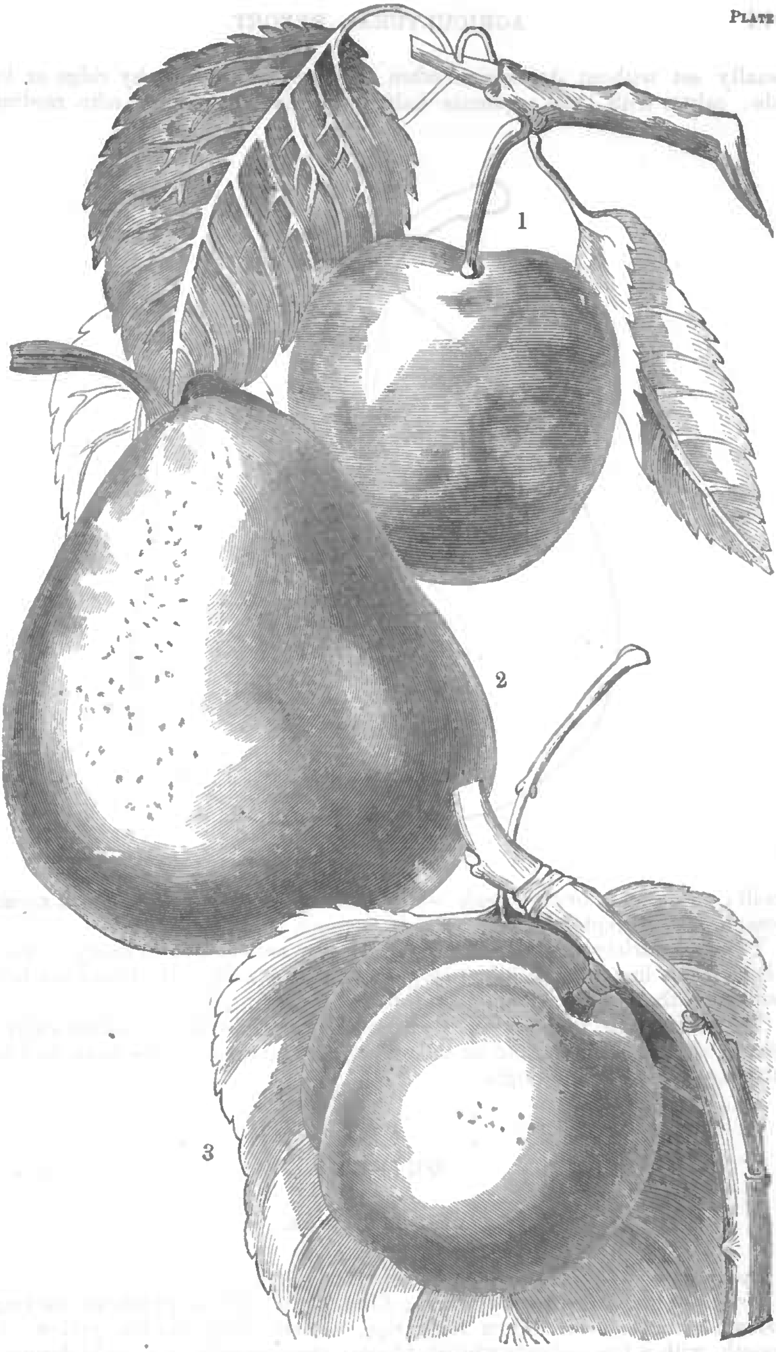
Tree.—A vigorous grower, with an ovate pointed leaf. This variety is the one most generally grown throughout the country. If left on the tree until fully



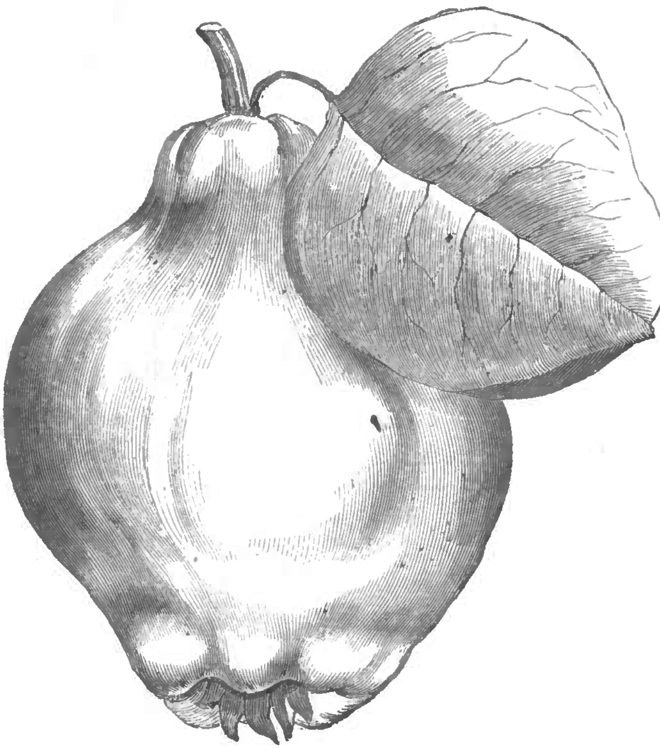
1.—DOYENNÉ GRAY.
2.—EARLY RICHMOND.



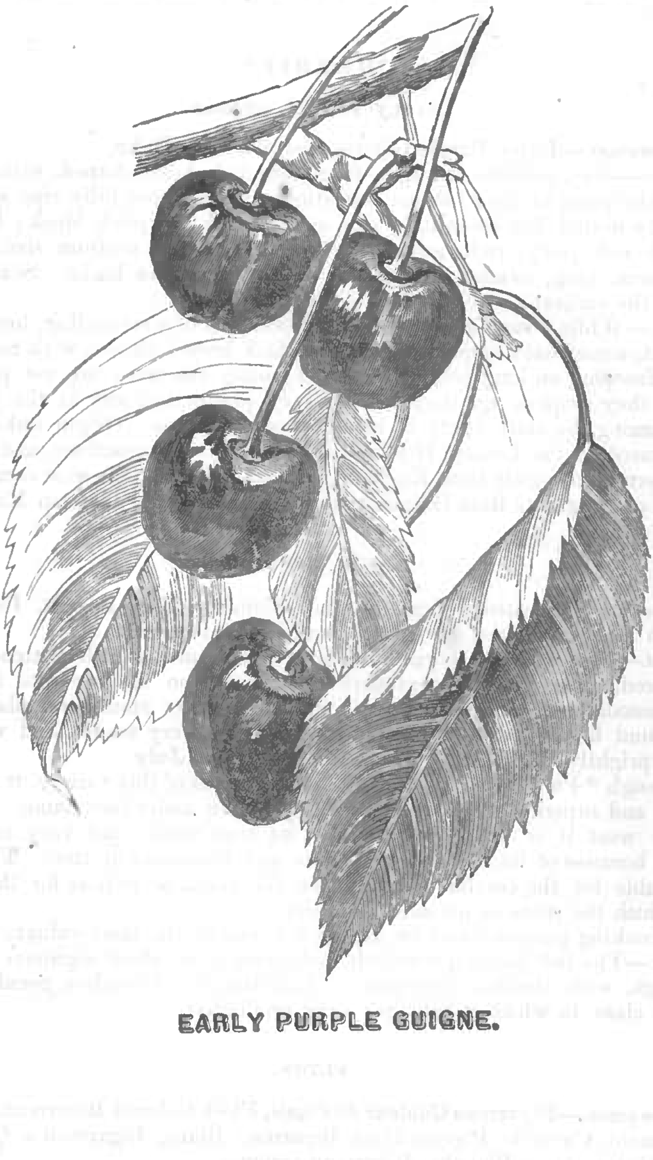
1.—EARLY YORK.
2.—WASHINGTON.
3.—COE'S GOLDEN DROP.



1.—IMPERIAL GAGE.
2.—JALOUSIE DE FONTENAY VENDÉE.
3.—BREDA.

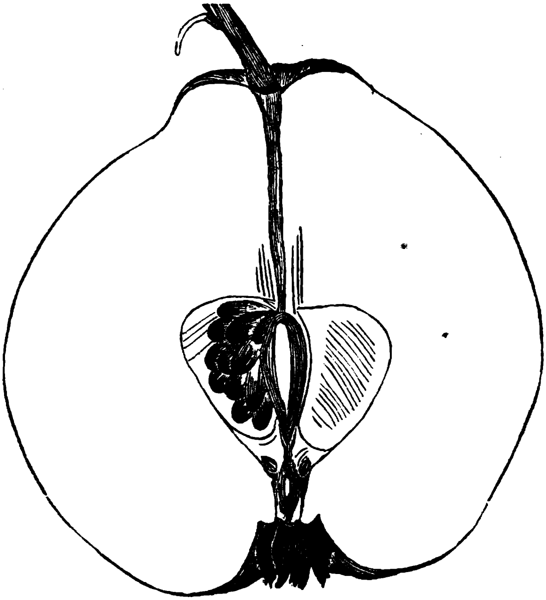


PORTUGAL QUINCE.



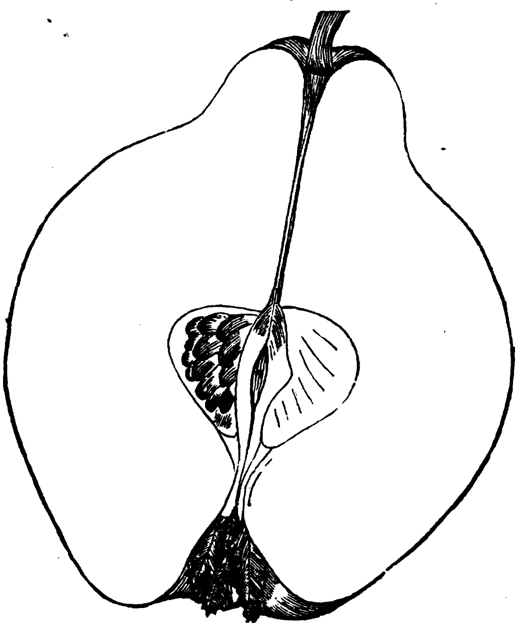
EARLY PURPLE GUIGNE.

ripe it cooks perfectly tender, but if gathered too early, when cooked it becomes hard. Seedlings from seed of this variety are sometimes sold as the



orange quince; but as the variety cannot be grown true from seed any more than any other fruit, all such plants are of course false.

PORTUGAL QUINCE.



Fruit.—Size, medium to large; form, regular, oblong, pyriform; skin, smooth; color, pale yellow; flesh, mild, less astringent than other varieties,

and when cooked becomes very tender, and turns to a fine purple or deep crimson color; core, medium and placed near the centre; seeds, light brown. Season, middle to last of October.

Tree.—Upright, strong, healthy grower; leaf roundish obtuse oval, very downy underneath, enabling it to be readily distinguished from any other variety.

CHERRIES.

EARLY PURPLE GUIGNE.

Synonymes.—Early Purple Griotte, German May Duke.

Fruit.—Size, medium to large; form, roundish, heart-shaped, with an indenture at the point or apex; suture, indistinct; color, before fully ripe a dark red, distinctly dotted, but when fully ripe a rich, dark, purplish black; flesh, dark purplish red, juicy, rich, sweet, and excellent; pit, medium size, roundish oval; stem, long, slender, inserted in a shallow, narrow basin. Season, June. One of the earliest as well as best of sweet cherries.

Tree.—While young a fair, healthy grower, but of a straggling, loose, irregular habit, somewhat drooping or pendant, dark brown shoots, with rather small leaves drooping on long petioles. While young the trees are not productive, but as they acquire age they become very productive, and at the same time prove among the most hardy of all the sweet cherries. Origin unknown. It was figured in the London Horticultural Society's Transactions, and imported by eastern pomologists from England, while its advent at the west came through a party of emigrants from Germany under the name of "German May Duke."

EARLY RICHMOND.

Synonymes.—Kentish, Virginian May, Common Red, Sussex, Pie Cherry, Kentish Red, Commune, Muscat de Prague, Montmorency.

Fruit.—Size, medium, borne in pairs; form, round, a little flattened; color, bright red, growing somewhat dark as it hangs on the tree until fully ripe; stem, usually one and a quarter inch long, rather stout, and planted in a deep round basin; flesh, of a reddish cast, juicy, very tender, and when fully ripe a sprightly rich acid. Season, last of May to July.

Although "Pie Cherry" is one of the synonymes of this variety, it is entirely distinct and superior to the variety usually grown under that name. Throughout the west it is well known under its true name, and very extensively planted because of its real value in fruits and hardiness of tree. The fruit is remarkable for the corolla remaining on the stalk, as well as for the tenacity with which the stone or pit adheres thereto.

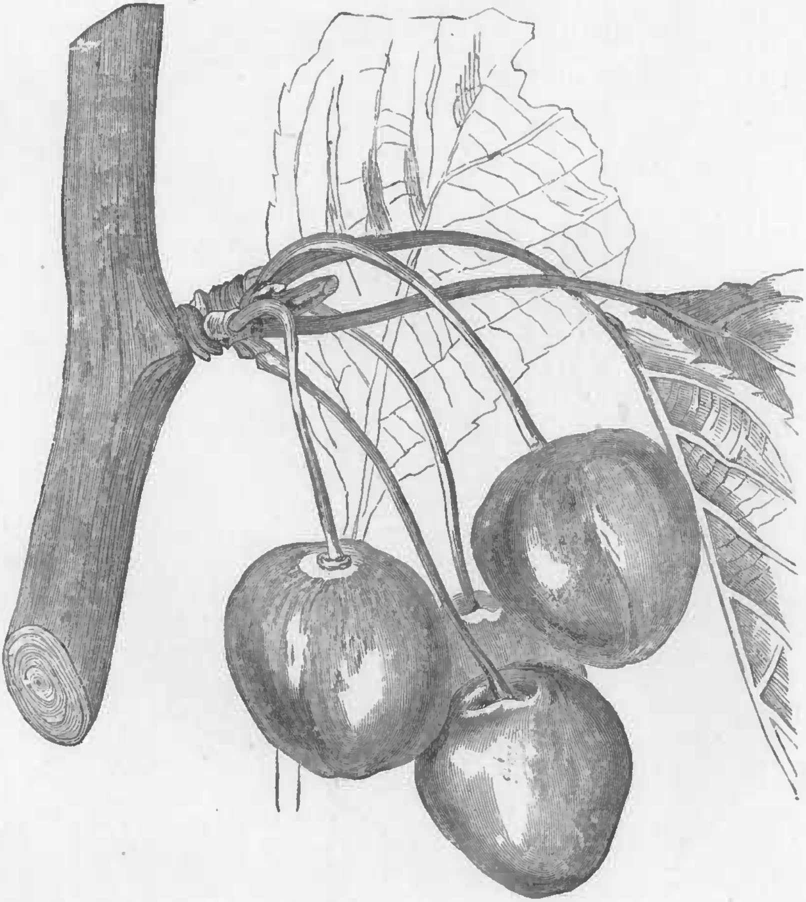
For cooking purposes and for drying it is one of the most valuable.

Tree.—The tree forms a roundish, spreading head, about eighteen or twenty feet high, with slender, close-grained, half-drooping branches, peculiar to the Morello class, to which it belongs; very productive.

ELTON.

Synonymes.—Bigarreau Couleur du Chair, Flesh Colored Bigarreau, Bigarreau de Rocmont, Cœur de Pigeon, Gros Bigarreau Blanc, Bigarreau a Gros Fruit Blanc, Guigne Gros Blanche, Bigarreau common.

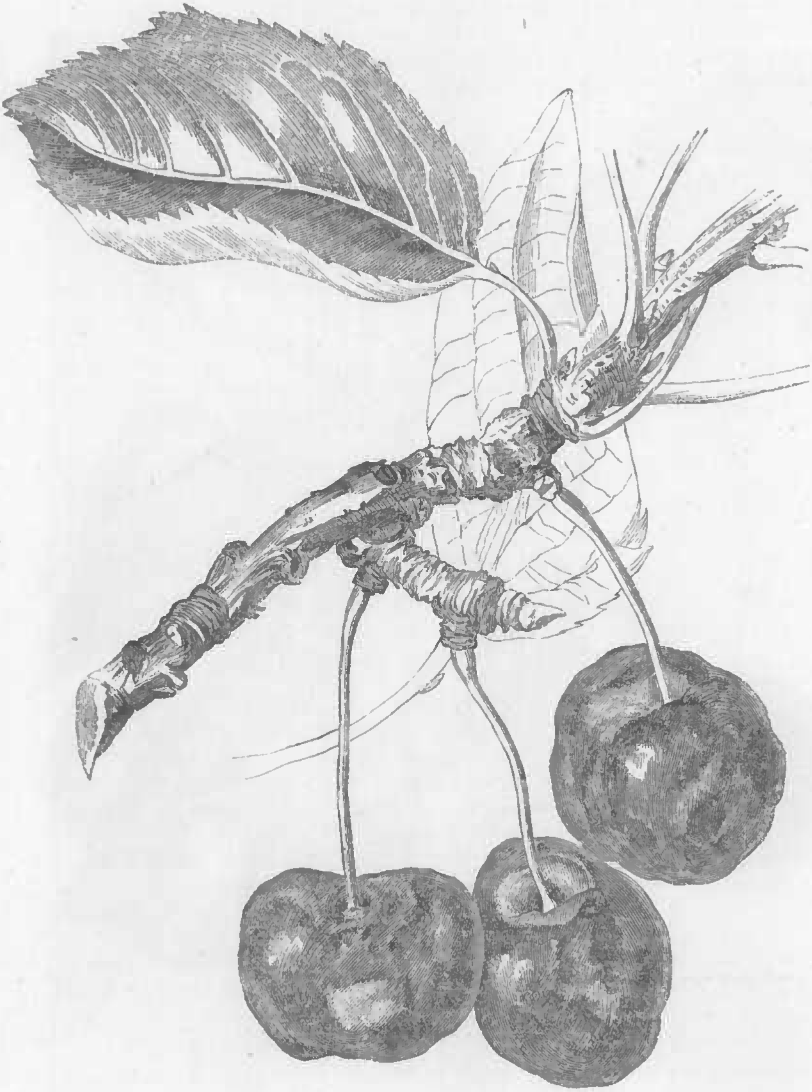
Fruit.—Size, large; form, long, heart-shaped, pointed; skin, thin; color, bright yellow ground, mottled and streaked with bright glossy red where exposed to the sun; stem, long and slender, set in a rather deep basin; flesh, yellowish, somewhat fine until fully ripe, when it becomes nearly tender, juicy,



ELTON.

11 †

BELLE DE CHOISY.



BLACK TARTARIAN.

rich, sweet, with an exceedingly rich, high flavor; pit, above medium, oval rounded, with a sharp point. Season, middle to last of June.

Tree.—A vigorous, spreading grower, with a slightly drooping habit, readily distinguished when in foliage by the dark red or purplish footstalks of its leaves; very productive. Origin, grown from seed by the then president of the London Horticultural Society, in 1806, and introduced to this country in 1823.

BELLE DE CHOISY.

Synonymes.—Ambree de Choisy, Cerise Doucette, Ambree a Gros Fruit, Cerise de la Palembre, Schone von Choisy.

Fruit.—Size, medium; form, round, slightly depressed; skin, thin translucent, showing the netted texture of flesh beneath; color, pale amber in the shade, mottled with red and yellow when exposed to and grown fully in the sun, and often becoming a bright carnelian red; flesh, amber yellow, slightly tinged with pink radiating lines or tissues in irregular long curves, very tender, juicy, delicate, mild sub-acid sweet, peculiar and deliciously agreeable; pit, small, round, a little pointed at apex; stem, often short, but varying. Season, last of June. This is one of the most delicious cherries for table use, but it is too delicate for marketing.

Tree.—A healthy, moderate, upright, half-spreading grower, belonging to what is termed the Duke family, and quite hardy. Originated in 1760 at Choisy, a village near Paris, in France.

BLACK TARTARIAN.

Synonymes.—Double Heart, Bishop's Large Tartarian, Fraser's Black Tartarian, Ronald's Large Black Heart, Black Circassian, Superb Circassian, Ronald's Heart, Fraser's Black Heart, Fraser's Black, Fraser's Tartarische, Schwarze Herz Kirsche, Black Russian.

Fruit.—Size, large; form heart-shaped, or obtuse heart-shaped; surface, uneven, with a slight suture half round; color, glossy purplish black; stem, strong and planted in a regular cavity; flesh, liver color, juicy sweet, half tender, separating freely from the pit; mild, pleasant, but not high flavor; pit, below medium size. Season, last of June. The fruit of this variety of the sweet cherries has perhaps a more uniform popularity than that of any other.

Tree.—Very upright, strong and vigorous grower, with large coarse foliage, and when planted in rich, strong soil, a little tender. Dry light soil suits it best, and even then it is often desirable to thin out the head, otherwise it becomes thick and the size and quality of the fruit is impaired.

It is supposed to have originated in Spain, and from thence transmitted to Russia, and thence to England, from whence it came to the United States about 1806.

REINE HORTENSE.

Synonymes.—Lemercier erroneously, Belle de Bavay, Monstreuse de Bavay, De 16 a la livre, Belle de Petit Brie.

Fruit.—Size, large; form, round, elongated with compressed sides; skin, smooth, with a glossy regular surface; suture, shallow, half round followed by a marked line, terminating at base in a knobby projection; color, bright lively red, marbled and mottled on amber ground; when grown fully exposed to the sun, it is mostly red; stem, generally two inches long, often doubly curved, slender; flesh, pinkish yellow, with radiating lines, distinct, but irregular in form; tender, and when fully ripe separating freely from the stone; frequently if not always there is a vacant space or hollow between the flesh and pit; sprightly mild sub-acid flavor; pit rather large, oblong rounded. Season, middle to last of July.

Tree.—Of the Duke habit, a healthy, vigorous grower forming a dense upright round head, very hardy even when grown in rich deep soils; it is of foreign origin, and introduced to this country in 1842. As a variety both for table and cooking combined with its hardiness of tree, and succeeding well everywhere, it stands perhaps almost first for general cultivation.

RED JACKET.

Fruit.—Size, large; form, regular, long, obtuse-heart shape; color, fine, clear, light-red, when grown in the sun, but of an amber color overspread with pale red, and often a russet yellow patch, when grown in the shade; flesh, with radiating lines distinct, half tender; juicy, sweet, pleasant flavor; if gathered *before fully ripe*, a little of the bitter belonging to the mazzard is apparent; pit, medium size; stem, rather long, slender, and planted in an open, moderately deep basin. Season, middle of July.

Tree—Very vigorous, upright, round head, with strong shoots and large strong foliage; one of the very hardiest of all the sweet cherries. Originated from seeds grown by Professor J. P. Kirtland, Cleveland, Ohio, in 1842.

ROCKPORT.

Synonyme.—Rockport Bigarreau.

Fruit.—Size, large; form, round obtuse, heart-shape; surface generally slightly uneven, and always with a knobby or swollen projection one side; color, clear, brilliant deep red, shaded and mottled on a pale, amber yellow, with occasional carmine spots. Stem, usually of medium length, one to one and a half inch; flesh, yellowish white, radiating lines irregular, a yellow tinge around the pit, firm, rich, juicy, with a sweet delicious flavor; pit, oval, regular and without ridges. Season, middle to last of June.

Tree.—Strong, vigorous, upright, very erect growth, with large, broad ovate pointed leaves. Originated in 1842 from seed sown and grown by Professor J. P. Kirtland, Cleveland, Ohio.

PLUMS.

COE'S GOLDEN DROP.

Synonymes.—Bury's Seedling, Coe's Imperial, New Golden Drop, Fair's Golden Drop, Golden Gage, Waterloo.

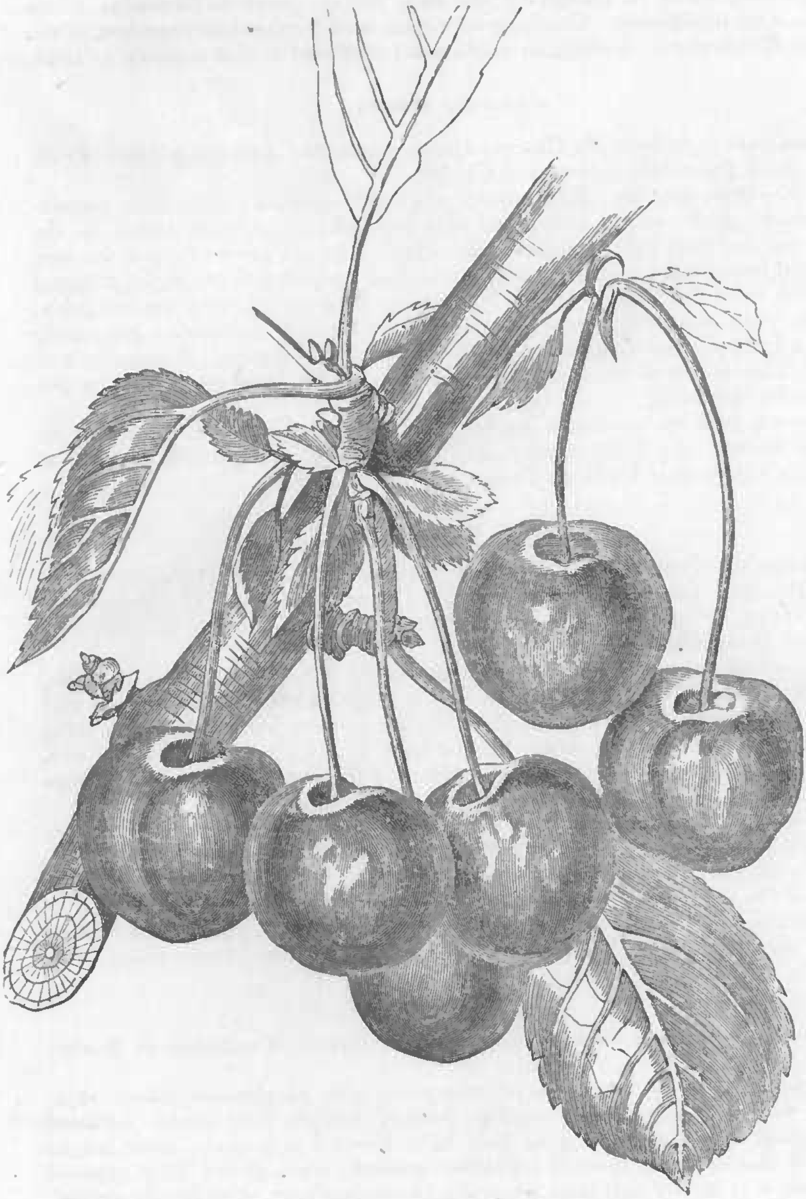
Fruit.—Size, large; form, oval; suture, well marked, one side enlarged; color, light yellow, much dotted or mottled with red on the side exposed to the sun; flesh, adheres to the stone, yellowish, firm, rather coarse-grained, but rich and sweet; stalk, three-fourths to an inch long, rather stout. Season, last of September. This variety does not always ripen well north of 40 degrees of latitude, but where it does ripen it is one of the very best varieties.

Tree.—Vigorous; short stout-jointed wood, with smooth, somewhat glossy branches; productive. Foreign origin.

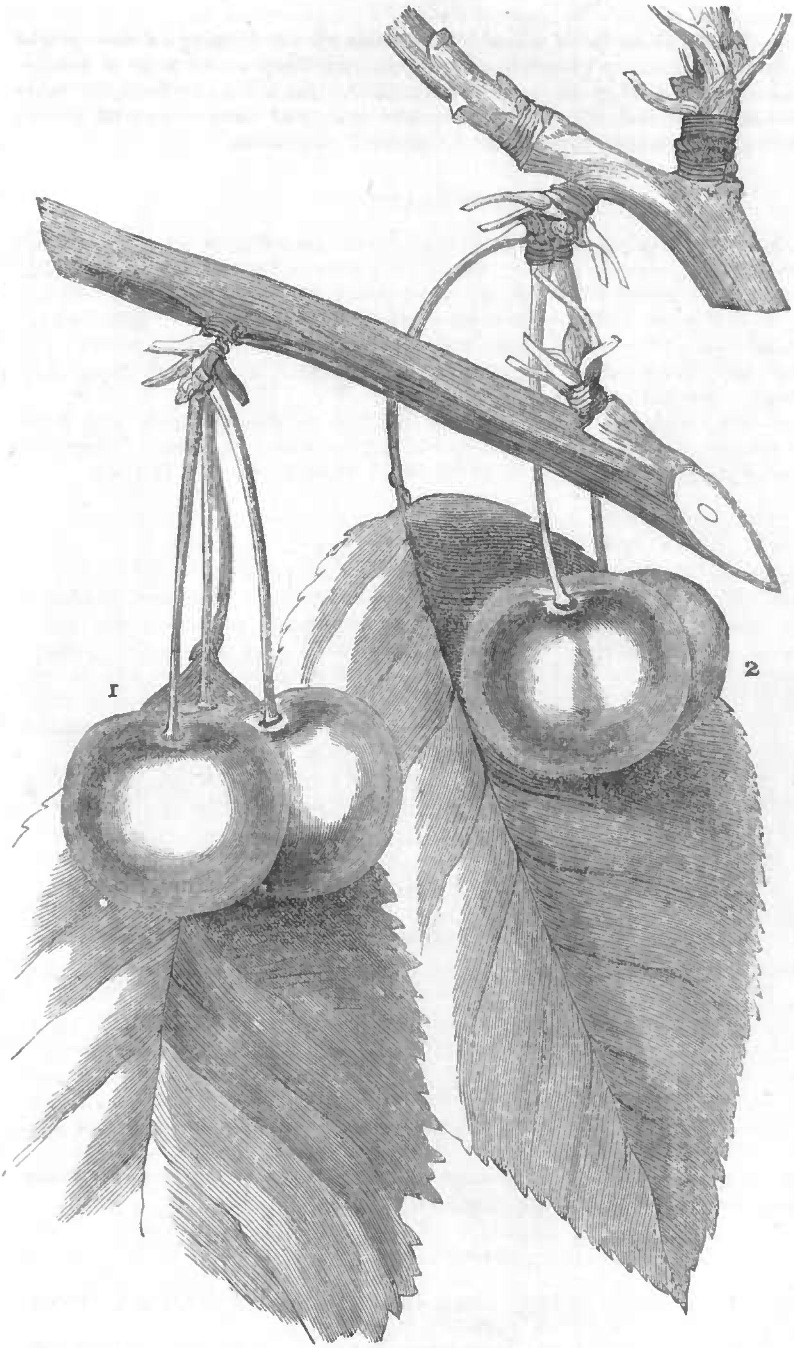
IMPERIAL GAGE.

Synonymes.—Prince's Imperial Gage, Flushing Gage, White Gage, Jenkinson's Imperial, Superior Green Gage.

Fruit.—Size, above medium; form, oval; suture distinct; color, at first pale green, with a white bloom, but when fully matured, becoming a yellowish green marbled with dark green stripes; stem, nearly or quite an inch long, hairy, stout, and inserted in an even hollow or cavity; flesh, greenish, very juicy, with

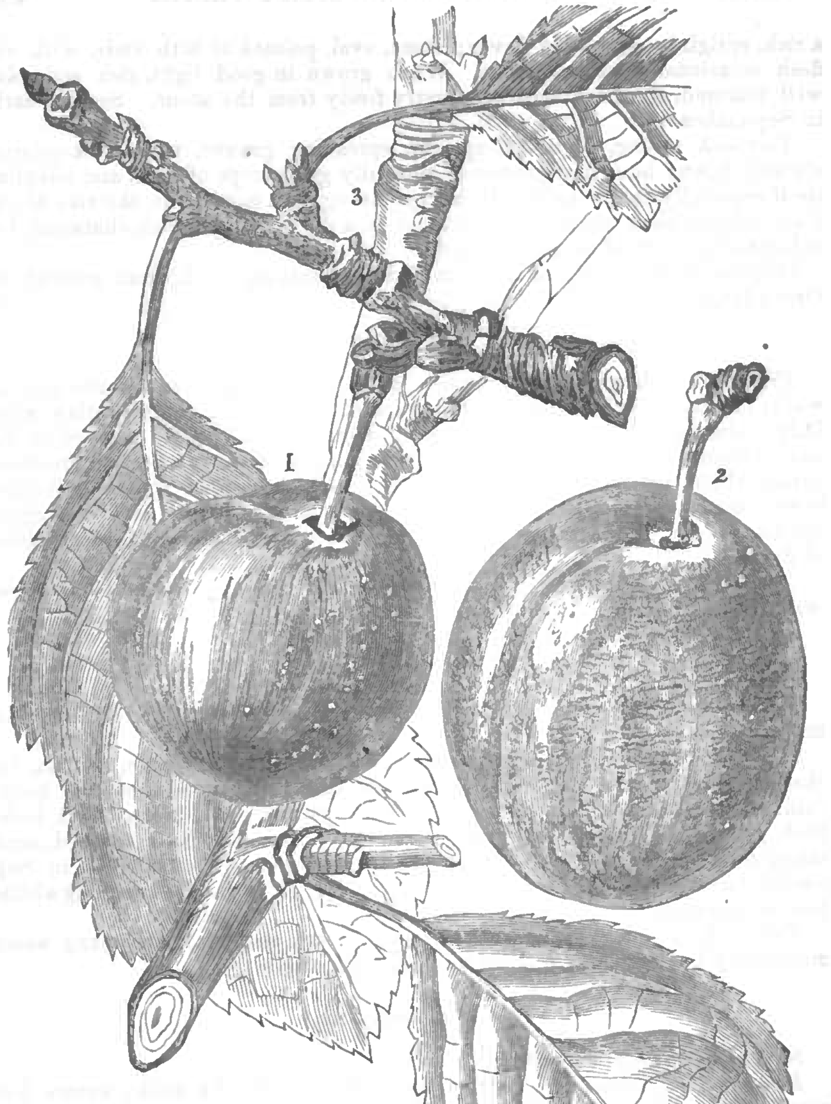


REINE HORTENSE.



1.—RED JACKET.
2.—ROCKPORT.

JEFFERSON.



1.—PURPLE GAGE.
2.—SMITH'S ORLEANS.

a rich, sprightly, agreeable flavor; stone, oval, pointed at both ends, with the flesh occasionally adhering to it. When grown in good light, rich soils, and well matured, the flesh separates pretty freely from the stone. Season, early in September.

Tree.—A strong, vigorous, upright, spreading grower, with dark-colored, slightly downy branches, producing annually good crops of fruit, and adapting itself especially to dry soils. In heavy, strong, and moist soils, the size of the fruit is larger than when grown in those of a dry, light, yet rich character, but it loses in quality while gaining in size.

Originated at nursery of William Prince, Flushing, L. I., from seed of the Green Gage.

JEFFERSON.

Fruit.—Size, large; form, roundish oval, slightly narrowed on one side towards the stalk; color, greenish yellow, at first becoming golden yellow when fully matured, and with a beautiful purplish, red cheek, where exposed to the sun; bloom, thin, white; stem, one inch long, inserted without depression; suture, slight, indistinct; flesh separating nearly free from the long, pointed stone; almost orange yellow, juicy, rich and sweet. Season, last of August, but hangs long on the tree even after ripe, and apparently improves in richness of flavor.

Tree.—A moderate grower, with strong, healthy, slightly downy young wood, with oval, flat foliage; productive.

PURPLE GAGE.

Synonymes.—Reine Claude Violette, Violet Queen Claude, Die Violette Koning Claudie.

Fruit.—Size, medium; form, roundish, a little flattened; suture, distinct, but shallow; stem, one inch long, pretty stout, and planted in a narrow basin; skin, a little thick; color, violet, dotted with pale yellow; bloom, light blue; flesh, greenish yellow, rather firm; rich, sugary, and very high flavored, separating freely from the stone; stone, oval, compressed. Season, early in September, but it often hangs two weeks after ripening, drying and shrivelling a little, but not cracking.

Tree.—A moderate, healthy grower, with smooth, short pointed, young wood; moderately but regularly productive. Foreign origin.

SMITH'S ORLEANS.

Synonyme.—La Delicieuse.

Fruit.—Size, large; form, obtuse oval, widest near the stalk; suture, half round, well marked; stem, slender, short, inserted in a deep, narrow, round cavity; color, purplish red, with small golden specks and deep blue bloom; flesh, yellow, a little firm, very juicy, brisk, rich, vinous, and adhering somewhat closely to the stone; stone, large ovate. Season, last of August. One of the most valuable varieties for market purposes.

Tree.—A very vigorous, upright grower, with straight, glossy, reddish purple shoots, and dark green, crimped leaves. Very productive, but deficient in flavor, except in light, rich, dry soils.

Originated by Mr. Smith, on Long Island, from seed of Old Orleans.

WASHINGTON.

Synonymes.—Bolmar, Bolmar's Washington, Franklin, New Washington, Parker's Mammoth, Irving's Bolmar.

Fruit.—Size, large; form, roundish oval; suture, well marked nearest the stalk; stem, short, a little downy, and planted in a wide, shallow basin; color, as generally grown, dull yellow, with faint marblings of green, but when fully ripened, the yellow is deep, with dots of red on the exposed or sunny side; flesh, yellow, firm, separating freely from the stone; stone, irregular, obtuse oval-pointed. An exceedingly valuable market variety.

Tree.—A strong, healthy, not rapid grower, very hardy, with broad, glossy foliage, forming a very handsome, round head.

Originated on the Delancy farm, once a suburb of New York city, and now known as the Bowery.

PEACHES.

EARLY YORK.

Synonymes.—Early Purple, Serrate Early York, Pourprée Hative.

Fruit.—Size, medium; form, roundish oval; suture, slight; skin, thin; color, pale green, or greenish white, dotted over with pale red, becoming dark red where fully exposed to the sun; flesh, greenish white, very tender, melting and full of rich, sprightly juice, and separating freely from the stone. Season, middle of August.

Tree.—A moderate grower, with firm, close-grained wood, large flowers, and leaves serrated without glands. The variety usually grown under this name is more vigorous in its growth, with globose glands and small flowers, a trifle larger in its fruit, but not as early nor as high flavored. It is more than usually hardy and regularly productive.

CRAWFORD'S EARLY.

Synonymes.—Crawford's Early Melocoton, Early Crawford.

Fruit.—Size, large; form, oblong oval, sometimes roundish, point at apex prominent; suture, shallow; color, yellow, with a red cheek; flesh, yellow, juicy, and, when ripened in clear, warm weather, is rich and sweet; at other times, slightly subacid, and separating freely from the stone. Season, last of August to 10th of September. A very profitable and valuable market sort—showy and large.

Trees.—Very rapid, strong growers, small flowers, and leaves with globose glands, productive, and, perhaps, quite as hardy, or more so, than most varieties. Popular everywhere, and deservedly so.

HALE'S EARLY.

Synonymes.—Early German, Hale's Early German.

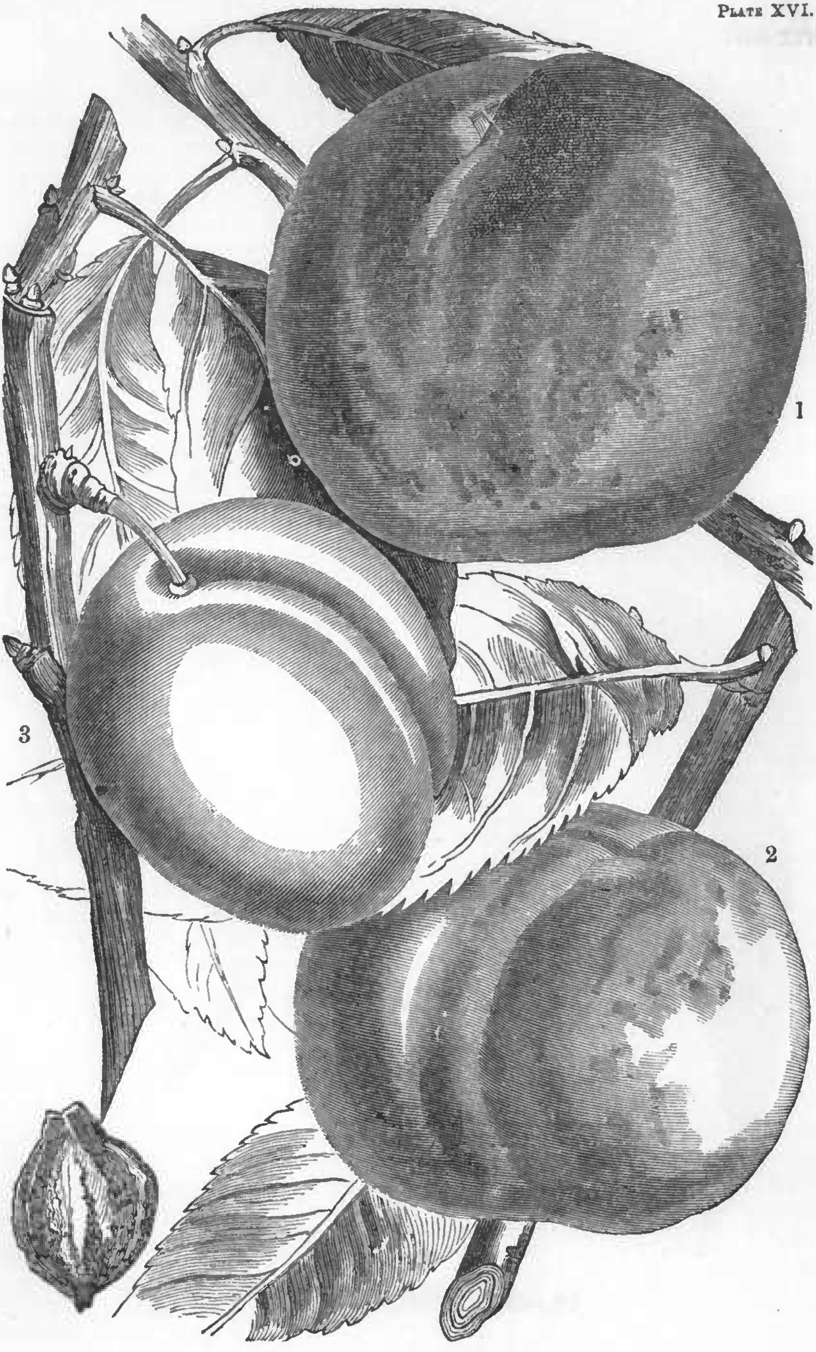
Fruit.—Size, rather below medium; form, roundish, compressed flat at apex; suture, deep, a trifle more than half round; color, greenish white to clear white, with lively red marbled, where exposed to the sun; flesh, white, with faint lines of red next the stone, to which it clings slightly, juicy, rich, and sweet; stone, small, very light brown. Season, middle of July.

Tree.—A healthy fair grower, with glossy leaves and globose glands, flowers small, hardy, and productive. Originated from seed planted by a German, named Moas, in Portage county, Ohio. It has become pretty extensively planted, and uniformly gives satisfaction as the best very early peach grown.

LATE ADMIRABLE.

Synonymes.—Royale, La Royale, Peche Royal, Bourdine, Boudin, Narbonne, Teton de Venus, French Bourdine, Motteux's, Judd's Melting.

Fruit.—Size, large to very large; form, roundish, inclining to oval; suture,



1.—OLDMIXON FREESTONE.
2.—HALE'S EARLY.
3. WASHINGTON.

CRAWFORD'S EARLY.

LATE ADMIRABLE.

PRESIDENT.

HEMSKIRKE.

bold, apparently dividing the fruit into two halves, and having a prominently swollen point at the apex; color, yellowish green, with the side next exposed grown towards the sun having two shades of red, mingled or marbled; flesh, greenish white, red at the stone, from which it separates freely; very juicy, melting, and of delicate delicious flavor. Season, middle to last of September. A most splendid fruit, suited to every garden, whether for private use or general market purposes.

Tree.—More than usually hardy, a moderate regular bearer, leaves with globose glands; flowers small. An old French variety, but wherever grown has received the approval of the best cultivators.

OLDMIXON FREESTONE.

Synonyme.—Oldmixon Clearstone.

Fruit.—Size, large; form, roundish, slightly oval; one side swollen or enlarged· suture apparent only at the apex; color, a mingling of yellowish white and pale green, more or less marbled with dull red, and having a deep red cheek in the sun; flesh, white, tinged with red at the stone, rich, sweet, vinous; excellent flavor. Season, early to middle of September.

Tree.—A hardy, good, not extra strong grower, the leaves having globose glands, and the flowers small. It appears to withstand late frosts better than most sorts, and rarely fails of producing a crop. For market orchards or private gardens it cannot well be dispensed with. American origin, said to have been produced from seed of a clingstone by Sir John Oldmixon.

PRESIDENT.

Fruit.—Size above medium to large; form, roundish oval; suture, shallow; color, pale yellowish green, downy, with red cheek where exposed to the sun; flesh, white, red at the stone; juicy, sweet, with a rich high flavor; stone rough pointed at apex end, and unless the fruit is fully ripe the flesh adheres slightly to it. Season, middle of September.

Tree.—A healthy, sturdy grower, having leaves with globose glands, and small flowers; very productive. Originated on Long Island.

APRICOTS.

BREDA.

Synonymes.—De Hollande, Amande Aveline, Ananas, Persique.

Fruit.—Size, small; form, roundish, often approaching four-sided; suture, well marked; color, orange, becoming rich brownish orange in the sun; flesh, deep orange, parting freely from the stone; juicy, rich, and high flavored; stone, small roundish compressed; kernel, sweet. Season, early in August.

Tree.—A hardy, healthy, and good grower, the blossoms of which withstand considerable frost in spring; productive of a high flavored though rather small dessert fruit, which hangs well to the tree even after ripe. Said to have originated in Africa.

HEMSKIRKE.

Fruit.—Size, above medium to large; form, roundish, compressed, or flattened on its sides; color, orange yellow, with a brownish red cheek; flesh, bright clear orange, tender, juicy, rich flavor; stone, small; kernel partially bitter. Season, last of July or a little before the Breda.

Tree.—With short, jointed, firm-grained, hardy wood, that produces crops of fruit superior in quantity and of equal excellence with Moorpark, from which it is known, from the stone not being perforated as with that variety.

GATHERING, RIPENING, AND KEEPING FRUIT.

BY J. W. CLARKE, GREENE COUNTY, WISCONSIN.

NOTWITHSTANDING the heavy drain made upon the national energies by the past four years of war, there has been a rapid increase in the attention given to fruit culture, both by amateurs and business men. This is evidenced by the immense increase and extension of capital invested and labor employed in that direction. The consumers of fruit, or those who require it as a part of their daily food, are a rapidly growing class, and when peace shall again have settled men down to permanent vocations, fruit culture will doubtless be advanced to its proper position as a leading national pursuit.

The expensive experiments now in process of trial in Ohio and Indiana of keeping fruits in huge air-tight tanks, on the principle of preserving a low temperature about them, even if successful and suitable to the wants of cities, can never supply the want of a simple and economical home method. This last is what is needed by all classes, and the chief object of the following remarks will be to draw the attention of fruit-growers to elementary principles connected with and influencing the success of their labors, and involving the application of intelligent skill to the ripening and preservation of apples and pears.

THE SHRINKAGE OF FRUIT

Will be considered first, because it is a subject which has as yet received little attention, and it is foreseen that popular views on this point may be urged against a practice which will be strenuously advocated, namely, much earlier gathering than is customary. It is important to modify the damaging and unsightly effects of shrinking if it be practicable. Some of the causes of it, such as early frosts, will probably never be within our control. Too much shade may of itself lead to some degree of shrinkage, but this must be slight, except when the heads of the trees are so thick with branches and leaves as to hinder a free and full circulation of air. Such shade hinders the circulation of juices in the growing fruit, which has much influence on its future perfection. Heavy fruit trees should be trained in forms sufficiently open to admit constantly a full circulation of fresh air, especially when growth is most rapid, as during close, still, sultry conditions of the atmosphere.

Early autumn frosts are more severe in their effects, by arresting the growth so as to leave the fruit undersized. A slight freezing, destroying merely the edges of the leaves, may pass without doing apparent injury at the time, but it will be found that shrinkage is an inevitable consequence of the arrest of growth. The destruction of the leaves, or some portion of them, in this manner, or by any similar process, is a certain cause of shrinking and undersize, particularly in apples. The gradual shrinkage, or almost imperceptible wasting away of long-keeping fruit, is not what is alluded to in these remarks; they apply especially to that rapid reduction of size known as wilting, shrivelling, or more properly, shrinking, from incomplete growth or insufficient nutrition.

A thin or poor soil, supplying the elements of growth in too limited quantity, and sometimes so in diversity, or both in part, may cause a stunted growth. It is only when the air is in motion that plants and trees derive organic matter from distant places; a fertile soil, therefore, becomes necessary to supply ingredients for a full crop of fair-sized fruit. A rich soil yields, so to speak, a local

atmosphere, by the exhalations arising from it, the gases of which are so much added to the general atmosphere in which plants literally live and breathe and grow. The farmer, at least, comprehends the futility of endeavoring to get large crops by too thick seeding, or by having too many stalks in a hill in his cornfield, or too many stools to a rod in his wheat; and the nurseryman, particularly as to trees intended for his own orchard, is studiously careful to give them ample room. This principle is as applicable to the fruit itself as to the trees upon which it is grown. Professional fruit-growers well understand the necessity and advantage of thinning their fruits when they set too thickly on the tree. It is only in this way that the finest growth and highest value are attained. Apples will not mature their growth unless supplied with a sufficient amount of fertilizing substances. On thin soils the fruit should be thin on the tree, and the surface mould cultivated or stirred so as to release the fruit-forming ingredients. Inside fruit shrinks the most, from being excluded from the sun's direct heat and light, they being as important and necessary as air to a healthy growth. Shrinkage appears to be the result of insufficient nutrition, which prematurely checks or arrests the growth of fruit, and a knowledge of the causes will suggest the antidotes.

INFLUENCES OF SOIL ON THE KEEPING QUALITIES OF FRUIT.

The great object being to keep fruit as long as possible and at the least cost, it is worth while to inquire not only how keeping qualities may be retained and increased after the fruit is grown, but into the known and probable conditions in which those qualities originate, and how they are imparted to the fruit during its growth. If there be any conditions of climate or soil, or both, which give to standard fruits the power of resisting decay for a longer period, or in which the same variety of fruit derives a firmer texture, finer grain, or larger size, either or all together, they should be generally and fully understood. There is a fact known to many retailers of fruit in the northwest which may throw some light upon this subject. This fact is, that of the apples usually in market during the winter months, those grown in parts of western New York open (in the barrel) in the best condition, and keep best while retailing. That this result is not from the influence of climate appears to be shown by another fact, which is, that in western New York itself the fruit grown on strong soil keeps longer than that produced on light soils.

In parts of Niagara county, in Wayne, and perhaps other counties, the pear is successfully grown on clay loam soils, or on soils correctly called strong or heavy. According to the experience of producer and consumer, a clay loam or strong soil, with a dry or porous subsoil, is the most favorable to good quality in both the pear and the apple. The writer may briefly mention what he has observed in England as to pears grown for cider or perry, as well as those for cooking and eating. In a district embracing the eastern part of Hereford county and the adjoining part of Worcester, to the northwest of, and back to the market town of Ledbury, may be seen thousands of acres of orchards, and among them many pear orchards of from one to five acres in extent. The celebrated Huff-caps and Borland pears, the juice of which enters so largely into the champagne of that country, are plentiful in a district adjacent. The growth of these trees is astonishing, many of them being forty feet high, and yielding crops of forty, sixty, or more bushels of fruit to each tree. There are acres together where the trees stand not less than thirty feet apart either way, the tops frequently interlap and come more or less in contact when the fruit is being gathered. On a farm a few miles west of Tewksbury, in Gloucester county, we have seen huge trunks of worn-out pear trees split up for firewood, and have been assured that they had generally been very productive. Another fact not without its bearing is this: the plantations or woods of forest trees, of which there

are several thousand acres, specially sown, trimmed, and protected for conversion to industrial uses, are generally remarkable for their thriftiness, elasticity, and durability. This is not common with woods of that country, (though the character of the climate is generally much the same.) On chalk lands, on the Cotswold hills, or on light sandy soils adjoining these famous fruit and timbered lands, there is but a small growth of wood and a comparatively limited number of trees. The causes of such fine growth and quality of wood and fruit must, therefore, be sought for in the soil. Minute particulars are not remembered, even if they were necessary; but the farm on which the worn-out pear trees, and many that were still flourishing, were found had a soil composed of red marl and clay in about equal parts, a very good wheat farm; there were no rocks upon it, but freely worked building stone in the vicinity. The latter, however, may have belonged to a different formation. The soil of the pear orchards was heavy and generally of red gray color, resting upon old red sandstone many feet in thickness. In the vicinity are soils more moist resting upon gray granite, but with few orchards upon them. The soil on the sandstone, though containing considerable marl, is frequently dressed with quicklime. The surface of the district is much broken, showing great changes in the position of its rocks, and there is no doubt that carboniferous limestones abound in many parts of it.

In the vicinity of Pittsburg, Pennsylvania, where fruit-growing is remarkably successful, the soil, according to Dr. Warder, is clay loam, resting upon sandstone, and mixed with it to some extent. The similarity between the pear district above described and that near Pittsburg is unmistakable in many respects. In Missouri and Iowa there are extensive clay loam ridges, resting in some places upon sandstone, and in others upon magnesian limestone or gravelly subsoil containing lime, where fruit of large size is grown, leaving no doubt that these must one day become successful fruit-growing districts.

I have raised two bearing orchards in the northwest; the first on a clay loam resting on a subsoil composed of similar loam and some gravelly limestone. This was white oak land, and both apple and pear trees rooted remarkably well on it and bore fair crops. The other orchard is on a light sandy loam with a subsoil of gravel and sand strongly impregnated with lime. The trees here, though they bear well, cannot mature a full crop of fruit, being poorly supplied with roots; and if they had plenty of roots, there is but little substance or solidity in the soil either to furnish a durable supply of nutriment, or from which the tree can derive that support and firm connexion characteristic of those growing in strong soils.

WELL-GROWN OR PERFECT FRUIT KEEPS BEST.

This is attested by general observation. Undergrown specimens of almost any variety of apple or pear are usually the first to be affected by rot or other agencies of decay. They are generally imperfect in form, and consequently in organization, which renders them more susceptible to the causes of decay than well-grown, perfect fruit. That perfect fruit does best resist decay is the strongest argument that can be made to show the necessity of allowing only as much fruit on the tree as can be fully perfected. It is very evident that an equal or given quantity of the elements of fruit formed into two or three hundred apples or pears of full size is, in such a number, far more economically organized than if formed into four or five hundred fruits of the same sorts.

GROWTH AS DISTINGUISHED FROM RIPENING.

Growth consists of increase of substance, either in regard to size or density, or both. The state of maturity has been sometimes confounded with ripeness, which is not a growing but a declining stage in the existence of the fruit. The

conditions of growing and ripening conjoin to form an apex or summit, as it were, to which growth ascends, and where the descending plane of ripening begins. We employ the term ripe to indicate not complete growth, or any condition of it, but an advanced and mellow state—an eatable condition.

EFFECTS OF RIPENING FRUITS ON THE TREE.

No coloring or other organic matters enter the fruit after it is full grown. This seems to be so obvious that a very brief consideration must lead to the admission of the statement as a self-evident truth. What result, then, can be attained by leaving fruit on the trees after it ceases to grow, whether it be full-sized or under-sized? The only advantage possible is the mellowing of the fruit, so that it may be more palatable. But fruit becomes mellow more rapidly when put in boxes or drawers in the house than when left on the tree. This fact furnishes an illustration of the truth that after fruit is ripe, disorganization is accelerated by a very slight increase of heat. This result is at once explained by the fact that the temperature about the fruit in the drawer is higher than that surrounding it on the trees, and thus accelerates its ripening. If the fruit were placed in a lower temperature the ripening would be retarded. Experiments made on this principle show that heat is the chief cause of ripening fruit. Heat breaks up the starch granules of fruit left to ripen on the tree, and this process mellows it both by evaporating portions of its water, and by weakening the adhesion of the grain of the fruit.

THE NATURE OF MELLOWING AND RIPENING.

Decay commences in the same conditions in which growth ceases, but so slowly at first as to be almost imperceptible. There is no state of absolute rest in growth or decay, or between them. From the time fruit attains its full size it is subject to incipient decay, and this influence is identical with the causes leading to a mellow or ripe condition; it is, indeed, the earlier part of the ripening process.

The effect of baking fruits, as illustrative of the influence of heat, consists in their changed color and loosened condition of texture; their appearance in general being similar to that of rotten fruit before it is broken. Indeed, but for the fact of certain desirable flavoring and other elements being retained in the baked fruit, probably because its albumen has not had time to escape, the process of baking might be designated as quick rotting from the disorganizing force of a sudden increase of temperature.

Apples, pears, and some varieties of small fruit may be kept fresh by the cooling influence of ice, in ice-houses. Experience has proved that equable and dry conditions of the atmosphere are the best for keeping fruit, and particularly staple fruits, like apples and pears. If cellars, fruit-rooms, and other places used for keeping fruit could have the air in them maintained in a dry and cool state, either by natural or artificial agencies, the probabilities of success would be greatly increased.

FRUIT RIPENED ON THE TREE DOES NOT KEEP WELL.

The practice of ripening fruit on the tree may be correct as to fruit required for early marketing, or for current use in the early part of the season, but does not appear to be satisfactory for keeping it in the finest condition for the longest period. A more even temperature than that about the trees, or at least one that is certainly no warmer, is necessary for this purpose, for reasons before stated.

SWEATING IMPAIRS THE QUALITY OF FRUIT.

It is observed that sweating affects apples more than other fruit, probably because they are oftener kept in bulk and under more varying conditions;

therefore, these remarks apply to them chiefly. Where fruit is placed in thick layers of over six or eight inches depth, a free circulation of air is much impeded, especially with fruit on the ground, or on tight floors where air has access only to the upper side of the heap. The air becomes saturated with the escaping moisture of the fruit, and there being but little circulation through the centre and lower part of the heap the moisture increases, and the accumulation of heat is sometimes so great as to lead to fermentation. In a little while the combined result of evaporation and fermentation is the rotting of the fruit. Nor is this the only injurious consequences of sweating in the heap; for there are most likely to be two processes of fermentation proceeding at the same time. Aside from that caused by the excess of humidity, which makes it sometimes greasy to the touch, there is the deteriorating action of the same influences breaking up the structure of the fruit itself. The sweating of fruit, therefore, cannot be too much deprecated or guarded against.

THE COLORING OF FRUIT.

In apples, especially the familiar red varieties, we find that some are but little colored; these are always such as are most shaded while growing. In a number of varieties one side is larger than the other; the larger side is that next the sun, from more sap flowing to that side. This difference is more apparent in some sorts than in others. The Tompkins County King, Early Harvest, and some other common varieties, are instances of this inequality between the sunny and shaded side. The same irregularity is observed in pears. The fullest or largest side of the fruit is almost invariably that which is most warmed and influenced by solar heat. Through the whole range of orchard and garden fruits the place to find the largest, ripest, and sweetest specimens is where the sun's heat has most influence. The precise nature of the causes which lead to this one-sided enlargement of certain kinds of fruit is not fully ascertained. Color, it is well known, exerts an influence on the absorbing powers of any substance as regards heat. Several dark colors increase this power, and greater radiation follows as a consequence. In substances of a given color, rougher or more unequal surfaces admit more heat than smoother ones. Fruit loses its coloring matter when ripened on the tree, and when the rate of evaporation is increased at the time the fruit is changing from growing to ripening, or directly after the growth is full. Gathering early results in the retention of nearly all the coloring matters, and the fruit afterwards becomes much brighter and more highly colored. This is a point of much importance, and should be better understood than it is.

EARLY GATHERING PROLONGS KEEPING.

If early gathering was more generally practiced, many of the conditions damaging to fruit would be prevented. This opinion is confirmed by experience through several seasons with Swaar, Yellow Bellflower, Westfield, Seek-no-further, Jersey Sweet, Maiden's Blush, Golden Russet, and other varieties. Members of the American Pomological Society of close observation have had analogous experience with the Bartlett pear. Specimens gathered two weeks before ripening, and having then scarcely any color on the sunny side, increased rapidly in coloring when ripening in the dark, and in that time presented a brilliant carmine tint. The condition of darkness can scarcely be considered as having a positive or active influence in bringing out the coloring of fruit, and can therefore be estimated as only collateral in importance and effect. Scientific observation alone can determine the extent or nature of its influence.

When the rate of growth is very slow, it is safer to gather fruit a little before it has done growing, for the reason that it is more difficult to check or arrest the incipient decay characteristic of the first stages of ripening or mellowing,

than to retard or measurably prevent its commencement. Early gathering insures the best results in keeping. Fitness for gathering is not always clearly indicated by outward appearance; but fruit for keeping should never be allowed to hang on the tree as long as it will. A test recommended by experienced pear-growers is when the stem parts easily from the fruit-spur. If this is correct in regard to the pear, it ought to be of the apple also. But there are many varieties which it would not be safe to trust to such a test; but some sorts will hang on long after they are fit to gather.

During the process of growth the seed cavity serves as a reservoir for holding a supply of juices, but when growth has nearly ceased, the moisture disappears from this cavity, and it becomes empty and comparatively dry. This condition affords two modes of judging of the degree of maturity the fruit has attained. One is, the slight rustling sound the seed makes when shaken; and the other is, to open some of the fruit as soon as this hollow state of the seed-cavity can be detected, and if the seed has changed to a pale brown color, it may be assumed that the fruit is fit to gather. It is not so safe to wait till the seeds are a dark brown. The general condition of the leaves as to color, and the degree in which they adhere to the branches, also afford means of estimating the state of maturity of the fruit.

After fruit is gathered its resistance to evaporation is increased by every successive reduction of temperature down to 32° Fahrenheit, when evaporation and the wasting of the fruit cease together. Generally the temperature of cellars and fruit-rooms is not, and need not, be kept down to that point.

Early gathered fruit can be so managed as to have it much more fully colored than if gathered late, and the keeping properties, which are even more important, are increased by the same management. The nutritive qualities must always be of higher value than mere appearances, though the latter greatly affect prices in market. Early gathering insures both results in the greatest perfection.

ROADSTERS AND TROTTERS.

BY THOMAS S. LANG, NORTH VASSALBORO', MAINE.

PERHAPS no department connected with the breeding of domestic animals in the United States has received so little systematic and intelligent attention as the production of first-class roadsters and trotters.

Great and successful efforts have been made in England and France to improve to the utmost that class of horses known as thorough-bred or blood horses; and also to produce a proper cross for hunters, each class for a definite use, to which they were bred with closest care.

There has also been much pains taken in this country to breed the same class of horses, and also to preserve their pedigree and performances.

The results have been gratifying to lovers of sporting stock, showing conclusively the value of careful breeding in the direct line of the qualifications desired.

To breed from stallions presenting to the eye a symmetrical form and fine size, does not insure the offspring to possess fine size and symmetry, only in proportion as the progenitors, both sire and dam, for several generations, may have possessed like good proportions.

While it seems well established that the form of colts for the most part is determined by the sire, which may be attributed to the sires generally being

better bred, yet I have in mind several stallions of good style so badly bred as to produce animals of the most indifferent character, and with but few distinguishing traits of the sire; and, in most instances, where these stallions were stinted with mares of high nervous energy and good breeding, their own qualifications were almost entirely lost, the dam, on account of her stronger determining power, overbalancing the influence of the horse.

This, then, should show us how important it is that stallions should be selected with care, as the individual type of what we wish to produce, and that his antecedents are such as will warrant a reasonable certainty in the result.

Therefore, a breeder desiring a class of trotting horses, regardless of their size and style, or carriage, need simply to select a stallion with remarkable propelling powers and satisfactory lasting qualities, being sure that these qualifications are the result of close breeding and not of chance.

I do not mean by close breeding that they must be found in some branch of some thorough-bred family, as the term thorough-bred is sometimes accepted or used, but that a stallion should be from a line of trotting animals that have been bred especially to such movements; and if they can be found possessing the thorough-bred strain, how much more valuable, and with how much more certainty may we expect satisfactory results from their use.

May I be allowed to mention an example, to prove this theory—the horse well known as "Rysdick's Hambletonian," by "Abdallah," by "Mambrino," by "Imp. Messenger," dam of "Hambletonian," by "Imp. Belfounder," Granddam, "Old One Eye," by "Hamiltonian," he by "Imp. Messenger," and dam of "One Eye," by "Imp. Messenger."

Now, if the reader will obtain a list of the remarkable animals produced by this excellently bred horse, he will at once see the value of close breeding to certain qualifications.

Had some favorite son of "Imp. Messenger," however, been selected for his running capabilities, and bred to notable running mares, should we expect, after several generations in breeding, the splendid trotting animals that are now the product of "Hambletonian?"

We need not by any means believe that we have yet arrived at the highest point attainable for speed.

The tremendous stride of the colts of Hambletonian and other like-gaited horses must gather energy and stoutness, as they are constantly bred to the best mares of like qualities.

I have, however, noticed a tendency to lose sight of symmetry and a beautiful carriage in the efforts of most breeders. Symmetry, good size, color, and style of going are most important qualities to be added to speed, and the careful breeder should always attempt to combine all these in the animals produced for roadsters and trotters.

A long, slashing-gaited trotter is not often a pleasant roadster; neither is a short, rapid, pony-gaited animal often a good trotting horse; yet a combination of these qualities makes a good "gentleman's horse," and often a good trotting animal also.

If breeders desirous of raising the most valuable class of horses for general use, as "gentlemen's driving horses," would not allow speed alone to make the *sine qua non* of their efforts, we should see more such animals as were shown by Mr. Hitchcock, of Connecticut, at the New England fair, at Springfield, in the fall of 1864.

These animals, the product of the horse "Ashland," combined fine size with beautiful clear color, highest breeding, and great speed.

There are, also, such horses as Goldsmith's "Volunteer," by "Hambletonian;" and Thorne's "Hamlet," by "Volunteer;" "Haphazard," by "Ashland," also owned by Mr. Thorne; most splendid types of gentlemen's horses, with the rare combinations of great beauty, great speed, and good antecedents.

I have mentioned these animals, as they are, in my opinion, of great merit. There may be many others equally good, but these I have examined with admiration.

Let our breeders breed with such types for both dam and sire, and in a few years we should see the finest class of horses in the world.

I do not wish to be understood that it is indispensable to obtain beautiful specimens of the sire only; certainly not. On the contrary, my own experience goes to prove the doctrine that the dam influences the form of body, temperament, and otherwise modifies the general structure, more or less, as she is more or less possessed of high nervous power. I have also, in my short experience, observed several marked instances of mares that could not claim very careful breeding; yet, I believe they were of such high nervous power as to control the character of the colts they produced for several years in succession, although bred to different and well-bred horses.

This leads me to remark upon the influence circumstances may exert upon mares wholly disconnected with general laws of reproduction, which may often lead one astray if not carefully noted, and tends to throw discredit in some minds upon the general laws which govern reproduction.

I have noticed that a marked departure from the general rule, that "like produces like," may almost always be traced to certain causes, not always the result of consanguinity, or traceable to like qualities in progenitors. For instance, mares of high nervous temperament are often very intractable and irritable during their periodical heat, and although well bred, and stinted to a well-bred horse, may produce offspring most unsatisfactory, the result of the state of temperament which the dam was in at the time of stinting. I know a black mare, from a black dam and grand-dam, and a black sire, that, being stinted to a black horse of great nervous energy during a period of nervous excitement, having been separated from her companion, a bay horse with blazed face, one wall eye, four white legs and feet, produced a colt that was black, with blazed face, one wall eye, and four white legs and feet, as unlike herself, or the horse stinted to her, as possible in other respects, but very similar to her companion who had been near during her period of heat, and by whom no issue could have been produced.

This is one marked instance among many within my knowledge—and such facts are valuable thus far—that all nervous mothers should be placed for a season in sight of and near the horse intended to be stinted to them, that mental affinity may also assist natural laws in producing like.

Here let me remark, that the practice of stinting mares early in heat, or too late, although it may answer the purpose so far as to cause them to become fruitful, yet the natural influences producing this state being absent, the mental condition is not favorable for the best results; and in this connexion I may mention the practice of trying luck by stinting mares to various horses, which is a practice much to be deprecated, where we wish to transmit qualities with any certainty, as the first impregnation of the female influences, in a great degree, all subsequent ones.

When any definite results are desirable, we can never rely upon a mare that has produced offspring by another horse than the one whose qualities we wish to transmit. Many pages might be filled with examples which go to prove this point, which have come under my observation.

Breeding in-and-in is also one of the breeder's strong points, as it brings him much more readily to a fixed type, and I have as yet seen but few instances that were not satisfactory, unless the animals, both sire and dam, possessed some radical defects. To what extent this might be practiced without injury to the physical organization I am unable to say. I am aware, however, that it is agreed that after twice in-and-in the constitutional powers become impaired, and the physical vigor reduced to a lower standard.

I cannot state from personal observation that this is, or is not so, as it would take many years to demonstrate this thoroughly, but I am convinced of the value of inbreeding in fixing the type, and should so far recommend it to breeders of roadsters and trotters, always bearing in mind that defects are as often transmitted as good qualities, and that extreme care should be exercised in the selection of animals to be so bred.

No animal, either sire or dam, should be bred from, which has constitutional unsoundness. Such defects may not show themselves in the offspring, but are quite sure to be there or in subsequent progeny; nor should any animal be bred from, which is not in full vigor.

In pursuance of this principle, I require all my stallions to be kept at daily exercise during the service season, not overheating them, but require them to receive from six to twelve miles of road work, walking, jogging, and occasionally, when they show superabundance of spirits, a slight dash of speed. This enables me to more thoroughly cleanse the skin, open the pores, and induces good, healthy appetite.

I have tried the plan, pursued by some, to keep stallions at rest, or nearly so, during the serving season, but am not satisfied with it.

The stallion General Knox, a cut of whom prefaces this volume, has had for four years during the serving season, commencing April 1 and ending August 15, seldom less than ten miles' daily exercise, and often considerable care has been exercised to restrain his disposition to show high speed. The result has been to so keep the horse in active vigor as to show itself in the remarkable strength of his progeny, and the determination of their nervous qualities towards the sire, and also to enable the horse, with never over eighteen to twenty-four days' fitting, to meet his opponents on the track. On the 8th of September, twenty-two days after leaving the stud, he trotted a mile on the half mile track, or sand track, on Hampden Park, without a break, perfectly in hand, in 2.31½. Let it be borne in mind that four days out of the twenty-two he was being transported, leaving but eighteen days for rest and work.

I desire to be pardoned for introducing this here, but that I feel so certain of the position taken, that the progeny of any horse is better, and more nearly like the sire, when the physical condition of the sire is kept to the highest point. I do not mean that the stallion should be kept fat and sleek, and possess an extra amount of animal spirits, the result of rest and generous feed, but be possessed of strong muscle, and the whole system in perfectly healthy, "fighting" condition, and the spirits of the animal kept cheerful by kind, prompt, hearty treatment.

Mares to be bred should certainly be in good vigor at time of stinting; also be kept in good health, by either running at large or moderately exercised during pregnancy.

Colts should be weaned at five or six months of age, depending somewhat upon the ability of the dam to feed without injury to herself, and be fed with hay and oats.

I do not like the practice of feeding carrots or potatoes more than twice per week. Hay and oats make the best muscle. If the oats are not digested, have them bruised. The quantity to be used depends much upon the animal to be fed. It should be kept growing and healthy, but it is always a poor plan to let a colt get very fat—a state which induces disease. Let the growth be slower, and the joints are better knit, less fever in the animal, and a more valuable animal at maturity.

I may be allowed to say that the successful breeding of horses is attended with many difficulties, and to breed after the manner of the large proportion of farmers is poor policy and money lost. My own experience for a number of years taught me that I was going wrong, and that producing now and then a good animal was mere matter of chance. Science must assist. A knowledge

of the laws of reproduction, combined with good judgment, reduces breeding of roadsters and trotters, or horses of other qualifications, to certainty; and as gentlemen of means and leisure engage, as a let-up from business cares, in agricultural pursuits, this subject will afford a field of much pleasure, and as they are governed by science in selecting types, and good judgment in coupling and the management of such animals, success will surely follow.

HOLSTEIN CATTLE.

BY WINTHROP W. CHENERY, BELMONT, MASSACHUSETTS.

ENGLISH and American authors have in general devoted their attention to those races or breeds of cattle indigenous to, or which have become naturalized in, the British islands; and we have, accordingly, elaborate histories of the Devons, Herefords, Short-horns, Ayrshires, and others of lesser note, while the existence of the Dutch, Swiss, and many other valuable dairy breeds of continental Europe, has been entirely ignored, or they have been dismissed with a passing remark; hence, perhaps, it is that the Dutch race of cattle has not received that appreciation in this country to which they are entitled by reason of their pre-eminent dairy qualities, and also by their adaptation to the soil and climate of many portions of the United States.

Incidentally, however, we learn that dairy farming assumed prominent importance in Holland at a very early period, leading, of course, to the utmost care and attention in the selection and breeding of dairy stock, and that in consequence "a large and valuable race of dairy cattle existed there long before the efforts of modern breeders began in England."

Professor Low, writing in 1840 in relation to the Short-horn breed, says that at a period "near our own times, it appears that cattle were frequently brought from the opposite continent and mingled with the native varieties. They were chiefly imported from Holland, the cows of which country were the most celebrated of all others in the north of Europe for the abundance of their milk and the uses of the dairy. * * * The Dutch breed was especially established in the district of Holderness, on the north side of the estuary of the Humber, whence it extended northward through the plains of Yorkshire; and the cattle of Holderness still retain the distinct traces of their Dutch origin, and were long regarded as the finest dairy cows of England. Further to the north, in the fertile district of the Tees, importations likewise took place of the cattle of the opposite countries, sometimes from Holland and sometimes by the way of Hamburg from Holstein, or the countries of the Elbe. Sir William St. Quintin, of Scampston, is said to have procured bulls and cows from Holland, for the purpose of breeding, previous to the middle of the last century, and at a later period Mr. Michael Dobinson, in the county of Durham, visited Holland for the purpose of selecting bulls of the Dutch breed. Other persons had resorted for their breeding cattle to Holstein, whence the finest of the Dutch breed have themselves been derived. Of the precise extent of these early importations we are imperfectly informed; but that they exercised a great influence on the native stock appears from this circumstance, that the breed formed by the mixture became familiarly known as the Dutch, or Holstein, breed, under which name it extended northward through Northumberland and became naturalized in the south of Scotland. It was also known as the Teeswater, or simply the short-horned breed. * * * The breed communicates its characteristics readily to all others, and the first progeny, even with races

the most dissimilar, is usually fine. The females retain in a considerable degree the properties of the Holstein race, in yielding a large quantity of milk, in which respect they greatly excel the long-horns, the Herefords, and the Devons. In the property of yielding milk, however, the new breed is inferior to the older and less cultivated one, showing that refinement in breeding and a greater tendency to produce fat are unfavorable to the secretion of milk. * * *

"The district of Holderness, it has been said, early obtained cows from Holland, and became distinguished beyond any other part of England for the excellence of its dairy stock. Many cows of the Holderness variety are yet to be found, but generally they have been more or less mixed with the Durham blood. The effect has been to improve the form, but to impair their milking properties; nevertheless the modern Holderness still stands in the front rank of dairy cows, and the great London dairies are chiefly supplied by them."

The same author, in writing of the dairy breed of Ayrshire, says, that "it is stated on competent authority that even so early as the middle of the last century the Earl of Marchmont had brought from his estates, in Berwickshire, a bull and several cows which he had procured from the bishop of Durham, of the Teeswater breed, *then known by the name of the Holstein or Dutch breed*, and mention is made of other proprietors who brought to their parks *foreign cows apparently of the same race*."

Sanford Howard, in describing the Ayrshire breed of cattle, says, that "it is not improbable that the chief nucleus of the improved breed was the 'Dunlop stock,' so-called, which appears to have been possessed by a distinguished family by the name of Dunlop, in the Cunningham district of Ayrshire, as early as 1780. *This stock was derived, at least in part, from animals imported from Holland*." And Rawlin, writing of these cattle in 1794, says that they "are allowed to be the best race for yielding milk in Great Britain or Ireland, not only for large quantities, but also for richness and quality."

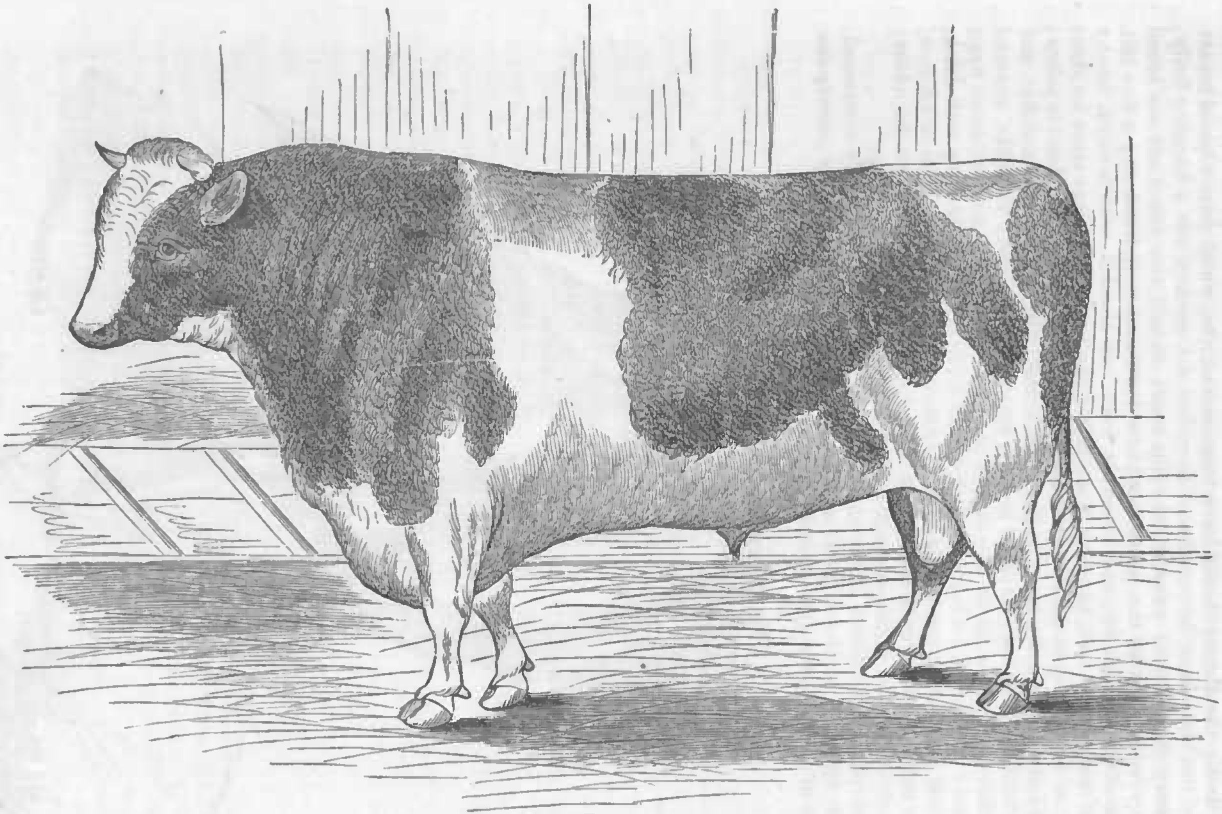
It will be observed that sufficient evidence is here adduced to show, not only that a race of dairy cattle of superior excellence existed in Holland at a very early date, but, also, that importations of those cattle into the British islands contributed greatly to the dairy qualities of both the short-horn and Ayrshire breeds.

For valuable information in relation to the present dairy stock of Holland, we are indebted to Charles L. Flint, esq., secretary of the Massachusetts Board of Agriculture, who, in his work entitled "Milch Cows and Dairy Farming," published in 1858, has so far deviated from the beaten track as to give a treatise upon the dairy husbandry of Holland; and, again, in his annual report for 1863, he gives a detailed account of his visit to the great international exhibition at Hamburg, embracing a very interesting description of the Dutch and other continental breeds of cattle.

He says that the attention of farmers in Holland "is at the present time devoted especially to the dairy and the manufacture of butter and cheese. They support themselves, to a considerable extent, upon this branch of farming, and hence it is held in the highest respect, and carried to a greater degree of perfection, perhaps, than in any other part of the world. They are especially particular in the breeding, keeping, and care of milch cows, as on them very much of their success depends.

"The principles on which they practice, in selecting a cow to breed from, are as follows: She should have, they say, considerable size, not less than four and a half or five feet girth, with a length of body corresponding; legs proportionately short; a finely formed head, with a forehead or face somewhat concave; clear, large, mild, and sparkling eyes, yet with no expression of wildness; tolerably large and stout ears, standing out from the head; fine, well-curved horns; a rather short than long, thick, broad neck, well set against the chest and withers; the front part of the chest and the shoulders must be broad and fleshy; the

PLATE XXI.

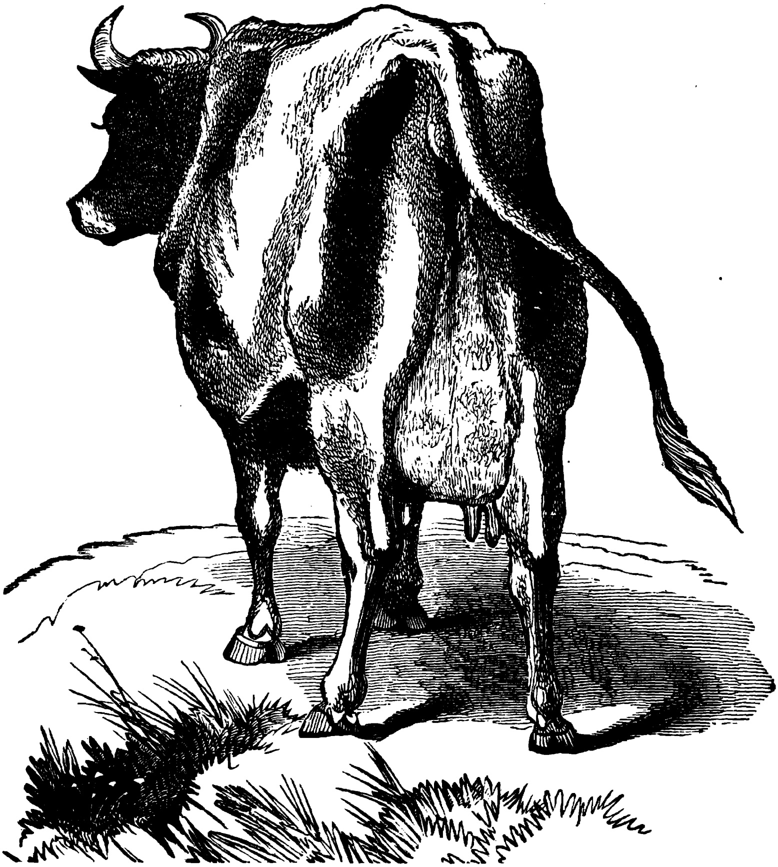


HOLSTEIN BULL "HOLLANDER."

Four years old; imported and owned by Winthrop W. Chenery, Belmont, Mass.

low-hanging dewlap must be soft to the touch; the back and loins must be properly projected, somewhat broad, the bones not too sharp, but well covered with flesh; the animal should have long, curved ribs, which form a broad breast-bone; the body must be round and deep, but not sunken into a hanging belly; the rump must not be uneven; the hip-bones should not stand out too broad and spreading, but all the parts should be level and well filled up; a fine tail, set moderately high up, and tolerably long, but slender, with a thick, bushy tuft of hair at the end, hanging down below the hocks; the legs must be short and low, but strong in the bony structure; the knees broad, with flexible joints; the muscles and sinews must be firm and sound; the hoofs broad and flat, and the position of the legs natural, not too close and crowded; the hide, covered with fine glossy hair, must be soft and mellow to the touch, and set loose upon the body. A large, rather long, white and loose udder, extending well back, with four long teats, serves, also, as a characteristic mark of a good milch cow. Large and prominent milk veins must extend from the navel back to the udder; the belly of a good milch cow should not be too deep and hanging."

The color of the North Dutch cattle is black and white beautifully contrasted. The figure of a Dutch cow is given which was giving daily *twenty-two quarts* of milk *a year after calving*.



"The Dutch cattle are, in general, renowned for their dairy qualities; but especially so are the cows of North Holland, which not only give a large

quantity, but also a very good quality, so that a yield of sixteen to twenty-five cans *at every milking* is not rare."

"In the province of North Holland, sweet milk cheese is made almost exclusively.

"From ancient times this particular branch of farming has been carried to great extent; but it has especially grown in importance since the province gained a firm soil by artificial draining. At the present time North Holland is the headquarters of the cheese trade, and it is easily explained in the fact that no other province has more or better cattle. * * *

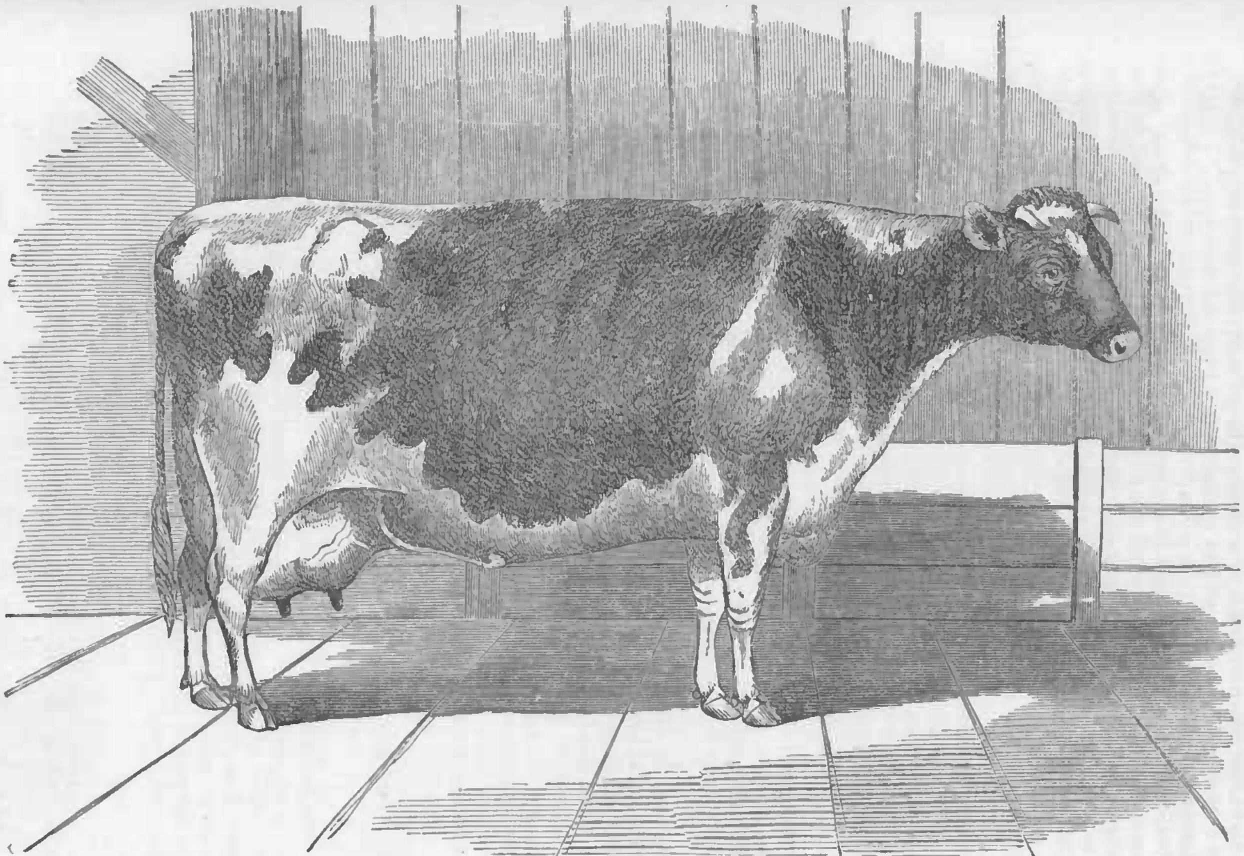
"In 1843 there were sold in the North Dutch cheese markets 22,385,812 pounds, to say nothing of the large quantity sold directly from the dairy. It is easy to see, therefore, how important and extensive an interest the manufacture of cheese has become for this province."

It thus appears that the present dairy stock of North Holland stands unrivalled, especially for cheese-making, and, in view of the inestimable value of the herds to the farmers of that country, it is not surprising that they "give their cows preference over everything else mortal. They are never overworked or underfed, as the wives and children sometimes are; they never lack blankets to keep them warm, nor shade to keep them cool; the warmest, best-built, and best-kept portion of the house is set apart for their winter habitation; their food is prepared with strict attention to their tastes; attendants sleep in their apartments to see that no harm comes to them at night; milkers are regularly roused to their duties at three o'clock in the morning, and during the day a door is generally open from their stalls to the rooms inhabited by the biped members of the family."

The first importation of Dutch cattle into this country was made by the Dutch West India Company in 1625, and subsequent importations were made by the early Dutch settlers in the State of New York. More recently—about the year 1810—the late Hon. William Jarvis, of Vermont, brought over a bull and two cows, which were placed upon his farm in Wethersfield. These cattle soon acquired an enviable local reputation which has been maintained down to the present time. A few full-bloods and some crosses are still remaining on the Jarvis farm; and, although they do not compare favorably with the latest importations of Dutch cattle, yet they are regarded in that part of the country as a very superior kind of large short-horn cattle, remarkably good for milk, both in quantity and quality. As working oxen, they have there a very high reputation, being large, strong, well-made, quick, and high-spirited, and have great endurance of heat. They are very muscular, and having great aptitude to fatten, the drovers and butchers have always esteemed them very highly. They are also considered there extremely valuable to cross with other breeds.

The latest importations of the Dutch cattle into this country have been made by the writer, who, in 1852, imported, as an experiment, a single cow. The extraordinary good qualities possessed by that cow led, in 1857, to a further importation of a bull and two cows, and in 1859 to four more cows. In consequence of a disease which occurred in 1859–'60, these cattle and all their full-blood descendants, with the single exception of a young bull, were seized and destroyed under a law of the commonwealth of Massachusetts, and in the autumn of 1861 another importation of a bull and four cows was made from North Holland, which, with the above-mentioned bull and their progeny, constitute the present herd of Dutch cattle at the Highland stock farm in Belmont, Mass., and it is believed that an examination of these cattle will afford satisfactory evidence that, while the English cattle-breeders have been improving and perfecting the beef-producing qualities of their short-horns, the Dutch dairy farmers have been improving their dairy stock until they have attained to a degree of excellence unsurpassed by any other breed.

A description of the imported animals of this herd will, perhaps, convey a



HOLSTEIN COW "TEXELAAR."

Five years old; imported and owned by Winthrop W. Chenery, Belmont, Mass.

very correct idea of the prevailing characteristics of the present dairy stock of North Holland. Their color is "black and white, beautifully contrasted," and they all have finely-formed heads, "with clear, large, mild, and sparkling eyes," short, fine, well-curved horns, and, in general, answering the description given in the foregoing remarks.

The bull Hollander was dropped in the spring of 1860, and is, therefore, at this time (1864) four years old; his girth is 7 feet 6 inches; length, 8 feet 1 inch; height, 4 feet 10 inches; weight, 2,025 pounds.

The four cows were dropped in the spring of 1859, and are, therefore, now (1864) five years old. Their dimensions are as follows:

	Girth.	Length.	Height.	Weight.
	Feet. In.	*Feet. In.*	*Feet. In.*	*Pounds.*
Texelaar	6 3¼	7 5¼	4 4	1,265
Lady Midwould	6 4	7 7	4 5¼	1,285
Zuider Zee	6 4	7 4	4 6	1,280
Maid of Opperdoes	6 5	7 6¼	4 5¼	1,225

The two-year-old bull Van Tromp weighs 1,700 pounds, and the heifer calf Opperdoes 3d, ten months old, weighs 725 pounds.

In illustration of the milking qualities of these cows, it may be remarked, that a careful record of the milk produced by the cow Texelaar, in the month of June, 1863, was kept, showing a result of *seventeen hundred and four and one-half pounds*, or an average of $56\frac{81}{100}$ pounds per day for thirty successive days. The first six days in the month she gave an average of $59\frac{4}{100}$ pounds daily, and on four subsequent days $60\frac{1}{2}$ pounds per day.

It will be observed that this cow was at that time but four years old, and she had then been in milk about two months, having dropped her calf on the 2d day of the previous April.*

The quality of the milk may be judged by the following extracts from the report of Prof. A. A. Hayes, Massachusetts State Assayer, who was employed to make chemical analysis of the milk of the four imported cows:

"*Results of analysis of four samples of milk received from Winthrop W. Chenery, esq.*

"The cans containing the evening milking of the cows reached me early on the following morning. Each can was sealed and accompanied by a certificate of Mr. Geo. H. Nichols, superintendent of Mr. Chenery's farm, who had put the milk in the cans. On opening the cans immediately, the milk in each was found fresh and cool, and its delicate organization uninjured.

"All the samples at 60° F. were from one-half to one degree above the average of Orange county milk by lactometer."

*The milking quality of this cow Texelaar is now (1865) again being tested, and shows a result in the seven days from May 27 to June 2, inclusive, of $512\frac{2}{16}$ pounds, or an average of $73\frac{2}{56}$ pounds per day. Her calf, dropped May 15, weighed at birth 101 pounds.

One thousand parts by volume afforded the following weights of constituents in samples:

	No. 1. Texelaar.	No. 2. Lady Midwould.	No. 3. Zuider Zee.	No. 4. Maid of Opperdoes.
Water, (produced)	850.20	879.30	874.40	869.59
Caseine and albumen	55.40	38.15	48.01	49.68
Sugar and salt	44.40	44.84	42.04	36.75
Pure butter	47.50	33.96	32.50	40.23
Phosphates, as bone phos	2.50	3.75	3.05	3.75
	1,000	1,000	1,000	1,000

"These milks, and especially No. 1, contain a larger quantity of albuminous matter than any samples which I have analyzed. This substance, found in all good milk, cannot be separated from the caseine so as to enable us to weigh it, and I have been compelled to include it with the caseine found. The albuminous substance is not only highly nutritious as a diet, but in the cases of these samples it confers a singular constitution on the milk, considered as an organized secretion. It divides the pure fatty part of the milk in a way to prevent it from rising in the form of cream copiously, and holds a part of it in what would be the skimmed milk, rendering it necessary, in order to obtain all the butter, that the *milk*, instead of the *cream*, should be churned. But its office has a more important connexion with the actual nutritive power of the milk, which it increases greatly in two ways: 1st. It is itself a highly nitrogenized product. 2d. It is in these milks so balanced in connexion with the butter as to be easily assimilated and digested without coagulation. These are valuable properties in their relation to the rearing of the young of the human or animal species, and I should expect to find these milks to possess fattening properties to an extraordinary degree, as indicated by the analysis."

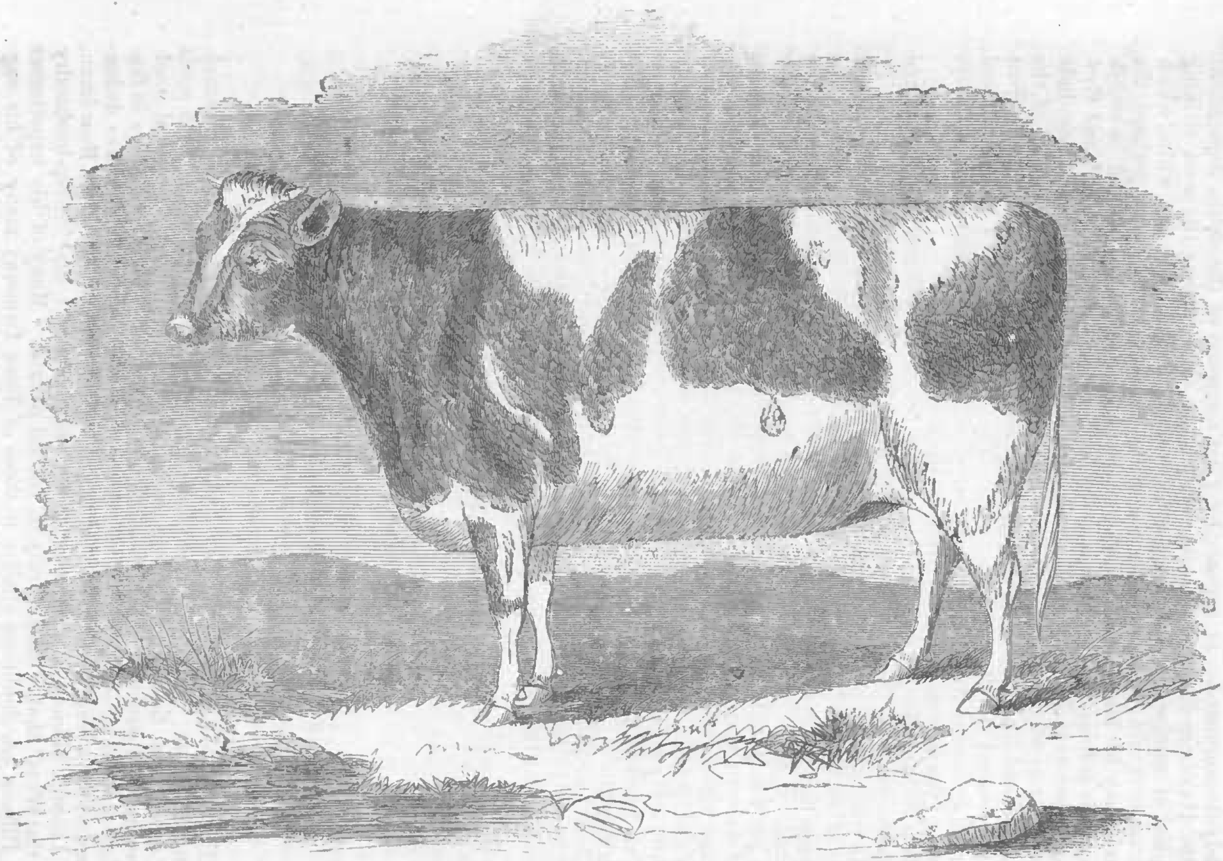
The statement of Professor Hayes to the effect that the analysis indicates the milk of these Dutch cows to possess nutritive power and fattening properties to an extraordinary degree is fully confirmed by experience, and it is found that the calves, in all cases when fed upon this milk, make very rapid growth. In one instance a calf dropped the 26th day of August, whose weight at birth was one hundred and ten pounds, was again weighed when eighty days old and found to have attained to a weight of three hundred and fifty pounds, an average gain of three pounds a day for the whole time.

In relation to the fattening properties of this importation of Dutch cattle very little can, of course, be stated as the result of experience, as no full-blood animal of suitable age has been fed for the shambles. It is, however, known as above stated, that the young animals make extraordinary growth; and it is also remarked that the cows, when not in milk, take on flesh very rapidly. Indeed, in consideration of their uniform large size, easy, quiet dispositions, and their early maturity, there can be no reasonable doubt of their value as feeding stock.

As working oxen, the Dutch cattle are unquestionably very superior, being not only large, strong, and well made, but quick, intelligent, tractable, and capable of withstanding the extremes of heat and cold to a remarkable degree. Grade Dutch oxen have been raised in this country attaining a weight of forty-six hundred pounds to the yoke at the age of five years; and it may here be stated, that calves produced by crossing the Dutch bulls upon native or blood cows of other breeds invariably resemble the sire in color and general appearance.

In view of the facts presented in the foregoing remarks, it is much to be r

Plate XXIII.



HOLSTEIN HEIFER "OPPERDOES 3d."

gretted that the Dutch cattle have not been more extensively imported and bred in this country. In Europe they are appreciated, and the breed has been widely disseminated. It appears by Flint's account of the cattle department of the Hamburg Exhibition, before referred to, that "among the most striking in point of numbers were the long and beautiful rows of black and white, which a stranger would be inclined to set down as all Dutch;" and "perhaps the Dutch may be taken as the most prominent type of these low-land or marsh races. It is found in its greatest purity in North Holland, Friesland, and Groningen, but is really very much more widely spread than we should conclude from the size of these provinces on the map. On entering the grounds of the International Exhibition the stranger was struck with astonishment at the great preponderance of these marsh cattle. The Dutch formed a prominent and marked feature in the show, the number of animals about a hundred and thirty, many of them from the finest herds in Holland."

It is further stated that the Dutch have been largely introduced and mixed with the cattle of Belgium, France, and other European states.

In conclusion it may be proper to remark that it is not claimed that the Dutch race of cattle are destined to usurp the place of the fawn-like Jersey upon the lawn of the aristocratic country gentleman, or supersede the noble beef-producing short-horn in the blue-grass pastures of Kentucky; but it is claimed that they are peculiarly adapted to the soil and climate of a large part of the northern and western portion of the United States, and that they are infinitely superior to any other breed for cheese-making, or for the production of milk for family use and for the supply of city markets; and, moreover, that they are pre-eminently adapted to meet the wants of the general farmer, combining, as they do to an extraordinary extent, the three desirable qualities of dairy, beef, and work cattle.

Accompanying this paper are portraits of the imported Dutch bull Hollander, the imported Dutch cow Texelaar, and the Dutch heifer Opperdoes 3d, animals described in the preceding pages, and truthfully delineated by the artist.

SHEEP IN IOWA.

BY DR. J. M. SHAFFER, OF FAIRFIELD,

Secretary of Iowa State Board of Agriculture.

The Hon. J. B. Grinnell, of Poweshiek county, Iowa, has written an excellent treatise on "Sheep on the Prairies," which may be consulted with profit by every man that owns a sheep in the northwest. Being a practical wool-grower, his instructions are of incalculable benefit. He does not indulge in fanciful speculations, but details experiences, summons figures, and makes deductions which a wayfaring man need not misunderstand. Samuel P. Boardman, of Lincoln, Illinois, has also prepared a valuable paper on "Sheep-husbandry in the West" that is well worthy of careful perusal. Many of his experiences in Illinois are doubtless similar to those of Iowa farmers; many of his suggestions will apply forcibly here, as there, and may be read with benefit. J. R. Dodge has given a splendid review of the "Condition and prospects of sheep-husbandry in the United States." This treatise exhibits a vast amount of industrious research, and, on account of its statistical tables, directions as to management, profits, varieties of breeds of sheep, &c., worthy of very careful

study and examination. All these papers may be found, thoroughly illustrated in the Report of the Commissioner of Agriculture for 1862. It is proposed in this place to discuss the question of *Sheep in Iowa*, and to note the peculiarities of the condition of wool-growing in this particular region. In order tc bring the several points considered more clearly before the mind, the subjec is divided as follows:

1. Statistics of sheep, and manufactures of textile fabrics.
2. The history of legislation in Iowa as to sheep.
3. Shelter, and how it may be procured.
4. Pasturage and grasses.
5. Some evidences of progress in sheep-growing in Iowa.
6. Manufactures, facilities for.
7. Profits.

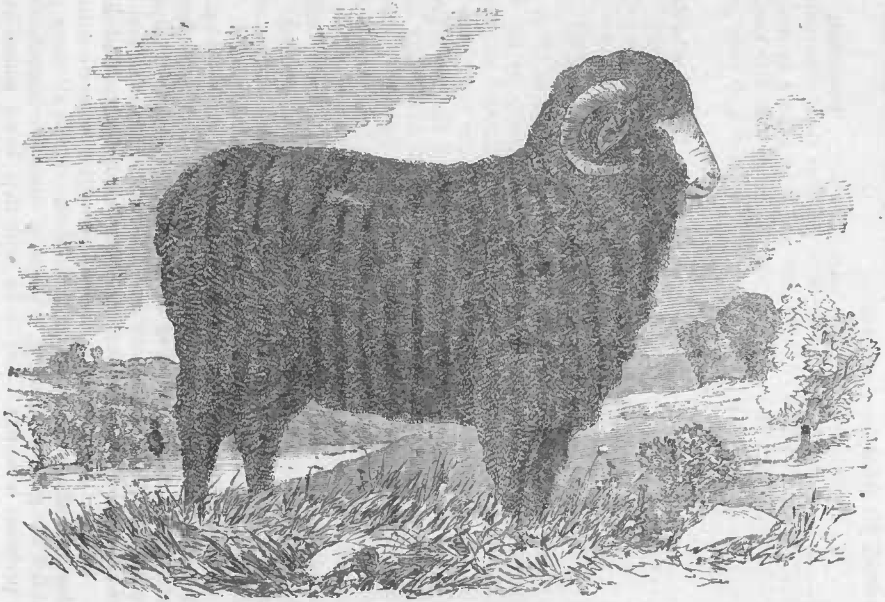
Details as to management, breeding, varieties of sheep, mutton, &c., are lef to persons of practical experience. Many questions legitimately connected witl wool-growing are exhausted in the papers above referred to, and in sundr valuable books devoted to sheep, and anything written here would be little mor than repetition.

In 1850 there were in Iowa, according to the United States census, 149,96 sheep; in 1860, by same authority, 280,495; in 1863, by State census, 599,938 During 1863 the different railroads brought in 63,819. This is but a smal portion of the actual number imported; and it will be safe to put down th number of sheep at the close of 1863 at 800,000. This should be regarded a a liberal estimate, though some persons place the figures 100,000 higher. Sinc January 1, 1864, the Burlington and Missouri railroad, running from Bur lington to Ottumna, a distance of seventy-five miles in the southern part of th State, carried west 35,031, and carried east 9,119 sheep, being a gain of 25,91 The Chicago, Burlington, and Quincy railroad, from Chicago to Burlington shipped for Iowa, during the same period, 40,257 sheep, showing that abou 5,000 head reached Burlington that were driven west, instead of being again pu in the cars. This road also carried east, from Iowa, 10,825 sheep, showing further increase from this point by exportation of 1,706. On the Mississip and Missouri railroad, running from Davenport to Grinnell, through the centra part of Iowa, a distance of about 125 miles, were carried west into Iowa 52,45 sheep, and east, 5,760, giving a balance in favor of Iowa of 46,690. Thus:

1863.		1864.	
By B. & M. R. R.	17,948	By B. & M. R. R.	35,03
By M. & M. R. R.	36,620	By M. & M. R. R.	52,45
Total	54,568	Total	87,48

Or showing an excess of 32,913 sheep by importation, over those two road alone, for 1864. At the McGregor ferry, running in connexion with the Mi waukie and Prairie du Chien railroad, there were carried west 25,000 head sheep. Through these avenues alone, then, the importations in 1864 are 112,48 This number, added to the natural increase of the flock, will show that at thi writing our sheep will not fall short of a million and a quarter. In 1863, fro the limited sources already mentioned, there were exported 6,289 sheep; i 1864 there were exported 25,704, or more than four hundred per cent. of a increase. (Let it be remembered most distinctly that these figures are onl partial returns, and make no pretensions whatever to show the *whole amou* of exportations and importations of sheep.) It is one of the most difficult task to collect agricultural statistics that will embrace the production of a who State, and particularly in Iowa, where the public avenues of trade are as y limited, and where, in many instances, no reliable data have been preserved

PLATE XXIV.



MERINO RAM "BOLD BOY."

Hammond Stock, ten months old, weighs 107 pounds, bred by A. S. Farr, owned by Grinnell & Chatterton, Grinnell, Iowa.

exhibit the minutiæ of business. In 1850 the proportion of sheep to population was less than one; and there was about one sheep to every six acres of improved land to the farm. The following tables will illustrate the progress of sheep-husbandry in Iowa, and will, better than any other way, show the immense strides which this interest has made the past few years. In fact, we are only surpassed by our sister Minnesota, which, in 1850, claimed but 50 sheep; and in 1863 reached the surprising aggregate of 175,000, or a multiplication of nearly 2,200, while Iowa multiplied her sheep by less than six in the same period. Would space permit, it would be pleasant to make comparative tables; but this paper is already assuming unexpected dimensions, and the absolute tables are presented for what they are worth.

Year.	Population.	No. of sheep.	Proportion.
1850	192, 214	149, 960	Less than 1 to each person.
1860	674, 913	258, 228	Less than ½ to each person.
1863	702, 162	800, 000	More than 1 to each person.
1864	715, 000	1, 250, 000	Nearly 2 to each person.

	Acres of land improved.	Proportion of sheep.
1850	824, 682	1 sheep to every 6 acres.
1860	3, 780, 253	1 sheep to every 13 acres.
1863	4, 784, 886	1 sheep to every 6 acres.
1864	4, 800, 000	1 sheep to every 4 acres.

In 1850 the whole product of wool is 373,898 pounds; and in 1860, 653,036 pounds; showing in 1862, 1,429,209 pounds; and the exports by the Chicago, Burlington, and Quincy railroad, and the Mississippi and Missouri railroad, reach, in 1864, 943,193 pounds, or the exports by only two of our main lines of communication with the east, within a half million pounds of the entire product of 1862. Here is a picture upon which the wool-grower of Iowa may look with a very great degree of complacency. He can see in these figures the vast wealth in store for him, and the sure reward he shall secure for his intelligent effort. It cannot fail to encourage him to look well to this great interest; to see that his flocks receive careful attention, and his fields, for their sake, more enlightened cultivation. Already almost a million of dollars have come to our State in 1864, through but two single avenues of trade; and he should take courage, and assist to swell the current until his brightest dreams are more than realized.

The value of home-made manufactures in Iowa in 1850 is placed at $1,631,039; in 1860, $847,251; and in 1863, $967,979. These figures are supposed to include only those articles of wearing apparel, blankets, linens, &c., made in the family. If the enumeration has been carefully preserved and the distinction marked, it shows a falling off of seven hundred thousand dollars in thirteen years. In the United States census there are separate columns for products of industry and agriculture; and in the State census all these products are included, under the general heading, "Value of domestic manufactures not included under previous headings." If it be true that Iowa manufactured in the family but $967,979 worth of clothing and textile fabrics, it presents no very flattering compliment to the industry and skill of the wives and daughters in this direction. It shows that in 1863, when the necessities of a terrible civil war call for retrenchment, less than a dollar and a half's worth of clothing material was made by each inhabitant; while in 1850, by the pioneers, who were just redeeming the State from the solitude of nature, nine dollars' worth were manufactured by each person. If "domestic manufactures" mean cloths, jeans, linsey, socks, blankets, sheets, linens, &c., it is not such a showing as we should expect at a time like the present. In fact, under this general heading for the whole United States, there was a decrease, even after adding products of Kentucky, Wisconsin, and Oregon, of nearly three millions of dollars in the

decade ending 1860. In 1850 the number of pounds of flax in Iowa reached 62,660, and ten years later it dwindled down to 28,888 pounds; but in 1863 reached 158,918 pounds, or multiplied itself by nearly six in the space of three years.

All the household manufactures of wool and flax, from this showing, will not furnish a tithe of the wearing apparel of the people. In fact, the experience is that homespun is the exception to our rule of clothing, and sheets, table-cloths, and other articles that could and should be made of flax in our own homes have been entirely supplanted by cotton. So the piano has supplanted the spinning-wheel, and innocent, yet unprofitable, parlor amusements the hum of the reel. Education has taught physics, philosophy, grammar, mathematics, and has forgotten economy, frugality, self-reliance, and patient industry. These ought it to have done, and not to have left the other undone.

With a gigantic civil war, calling upon all the resources of the nation, involving the people in a debt of nearly two billions of dollars, requiring unheard-of personal sacrifices, fixing a system of taxation that promises to continue a long time, it becomes not only sound economy, but the dictate of an enlightened patriotism, to increase the home manufacture of textile fabrics. The increase of six times the quantity of flax fibre in Iowa in three years, ending in 1863, is an encouraging omen, a healthy sign; and there was also an increase of $120,228 in the value of domestic manufactures. This is a most excellent beginning; let the figures be multiplied indefinitely; let every farmer have his flock, every family its loom and spinning-wheel, every county its machine for carding and manufacturing, and it is a giant step towards the preservation of our nation. This state of things would bring with it a return to the habits of simplicity of the fathers, and would do immense good, socially, politically, and morally.

The importation of woollen goods and fine fabrics into the United States assumes such immense proportions that the credulity of the student of the history of this time will be staggered. He will not credit the figures, when he reflects that a million of men have been called from the field and workshop; that a war prevailed four years; that a huge debt overhung the people; that thousands of persons, stripped of property and driven from home by the perils of war, depended upon charity for bread; and still this nation imported millions of dollars' worth of idle luxuries. When our fathers fought to found this government they refused to wear foreign goods; they organized societies which every way encouraged wool-growing, and stimulated the manufacture of woollens in the homes of the people; they denied themselves many comforts even, and were content to wear sackcloth, if need be, with the hope of building up a republican government, and giving freedom of speech, of conscience, and the press to their posterity. They have fallen asleep; they have committed to us the preservation of that government and those rights, and, instead of following their noble example, we have plunged into a system of extravagance that is absolutely dishonoring to their memory. "Money is plenty;" "we have made fortunes out of the war;" "our trade was never so prosperous;" "prices were never so high; "labor on the farm and in the workshop, everywhere, was never so remunerative:" let us, therefore, "eat, drink, and be merry." We cannot penetrate the veil which hides the future of our country, but it may be declared, with reason, that this folly and extravagance cannot continue without great peril to our free institutions. It will require many years of industry and many years of taxation to pay the national debt. This generation will not see the end; and, for the sake of posterity, it becomes us to return to the simple, frugal habits of the fathers, and abandon our present reckless waste of money, and to cultivate with energy all our advantages to become really independent. Instead of paying enormous sums for foreign articles of clothing with corn, wheat, and provisions, only in part, and the balance in gold, at

ruinous rate of premium, it behooves us to compel other countries, by manufacturing for ourselves, to buy our produce with gold. Instead of importing annually millions of pounds of wool to feed our machinery, it becomes us to make adequate preparation to increase our flocks, and grow wool enough for our people and a balance for exportation to clothe the other nations of the earth. The following table is copied from the very able address to the Ohio Wool Growers' Association, by Henry S. Randall, LL.D., January 6, 1864, showing imports of wool in 1863:

From whence exported.	Pounds fine.	Pounds coarse.	Total.
Europe	11,000,000	10,000,000	21,000,000
Cape of Good Hope	11,000,000		11,000,000
Buenos Ayres, &c.	15,000,000	6,000,000	21,000,000
Russia		2,000,000	2,000,000
East Indies and China		750,000	750,000
Spain and Portugal		750,000	750,000
Turkey	500,000	3,000,000	3,500,000
Mexico		1,500,000	1,500,000
Chili		2,500,000	2,500,000
Various places, in small parcels		1,000,000	1,000,000
Total	37,500,000	27,500,000	65,000,000

From the same high authority the following table is taken:

The value of wool imports into the United States for the last four fiscal years has been as follows:

Years ending—	Value.
June 30, 1860	$4,842,152
June 30, 1861	4,717,350
June 30, 1862	7,370,667
June 30, 1863	11,060,062

Does the wool-grower in Iowa need further argument than this solid phalanx of figures to induce him to look well to his flocks? The most obtuse in perception cannot but observe that there is no danger of a glut in the wool market just at present. The marvellous increase in importations shows the steadily increasing demand for woollen goods. The army of the Union absorbs an unusual quantity in blankets, shirts, drawers, &c., and when this cause of consumption is removed, it will probably lessen the price a little, but not enough to frighten even the most timid out of his confidence in the profits of the flock. Instead, then, of following the practice of continued importations, it becomes us to increase the flock, enlarge our manufacturing interests, establish factories all over the land, and clothe our own people more cheaply—because the expense of transportation is avoided—boastfully and thankfully, because our enterprise and industry are sustaining the best government under the sun. We may even allow the unhappy votaries of fashion to dress extravagantly, and the so-called rich to live luxuriously; but the millions who earn their bread by the sweat of the face may clothe themselves with home-made manufacture, and feel a pride that not the highest fashion or greatest wealth can purchase or enjoy. The hardy, trusty millions, who till the soil, dig our minerals, man our vessels, fight our battles, make our laws—these love liberty; these are men who perform the duties of an American citizen, and support with dignity the life of an American freeman; these are the men upon whom we must depend for reformation from the unparalleled extravagance of the present time. We must manufacture at the fireside all those fabrics which are so necessary to comfort, and the importation of which is so heavy a drain upon our finances. If every

family in our State had a spinning-wheel among its household gods, the effect would soon become visible, not only on our foreign trade, but in securing us that independence which is so comforting an element in our being. From all this, learn the profit of sheep-husbandry. Let us grow our own wool; let us manufacture it for our own use; let us become independent of foreign governments and sister States, and we add at once to our power, wealth, and comfort.

LEGISLATION.

The great sheep-growing interest received no special protection by law in the early history of the State. To be sure, a law was enacted paying a bounty for the scalp of certain harmful wild animals, as the wolf, lynx, &c., which, being numerous, committed depredations upon the flocks and domestic animals of the pioneer. A law of similar character is still on the statute-book. In 1861, however, a very stringent law was enacted against the importation and sale of diseased sheep. It provides that any person who should import, or suffer to run at large on any common, highway, or unenclosed lands, or should sell or dispose of any diseased sheep, should be punished by a fine of not less than fifty dollars. This act was deemed necessary because at that time many persons were beginning to realize the adaptability of this State to sheep-raising; and some unprincipled parties from other States, taking advantage of the desire of our people to purchase, and presuming something, perhaps, on their want of enlightenment on the subject, attempted, and in several instances are said to have succeeded, in selling flocks of diseased animals. These flocks were not merely a loss to the purchaser, but to the neighborhood, by the spread of the contagion. No prosecution has taken place under this law; but so great is the interest connected with the whole question of sheep, that an offender would meet with summary punishment at the hands of the authorities and people. It is believed that the prompt enactment of the law put an effectual stop to any future attempt to perpetrate so great an outrage and swindle as the sale of sheep affected with contagious disease. In 1859 many persons petitioned for a law to protect sheep from the ravages of dogs; but the bill was ridiculed beyond measure, made sport of, and finally defeated. Soon after the close of the eighth general assembly, the State Agricultural Society distributed throughout the State blank forms of petitions to the legislature to enact a law against the worthless curs that infested the country. A circular was also issued, under the same auspices, setting forth that a bill had been presented to the previous legislature; that it had been made the butt of brainless lawyers, and had been literally laughed out of the house; and calling upon the farmers to rise in their majesty, overwhelm the legislature with petitions, and compel them to protect this growing interest from the ravages of dogs. The petitions fell thick and fast upon the ninth general assembly, representing fifty-three counties, thirteen agricultural associations, and over three thousand people. Upon no other subject were so numerous petitions presented, and, in obedience to the apparently expressed will of the farmers, a law was enacted, of which the following are the principal features: To register every dog before May 15, 1862, with the township clerk; to pay one dollar for every male, and three dollars for every female dog; to post up a list of registered dogs in each township; to put a leathern or metallic collar on every dog, with the number; all dogs without such collar, a nuisance; fine not exceeding fifty dollars to maliciously kill or entice away any collared dog; lawful for any person, and made the duty of every police officer, constable, &c., to kill any dog not registered; lawful to kill any dog worrying any sheep or other domestic animal; fine any officer neglecting to enforce the law, ten dollars; all funds accruing to be set apart as a school fund, to be paid to the township district treasury; took effect by publication, being deemed of immediate importance.

The petitions out of which grew this enactment, as already intimated, set forth that hordes of worthless curs infested the country, to the serious detriment of the wool-grower, and prayed for a law to protect sheep against them. The dog-law, while it does not mention sheep, would undoubtedly have proved an immense protection to them, if executed. The tendency of the law was to diminish the number of dogs, and the less the number of dogs, the less the injury to sheep by dogs. During the few months the law was in force, many an uncollared dog met an untimely death; and school districts that were short of funds became suddenly plethoric in their treasury. The towns and cities did not hesitate to enforce the law; while the agricultural districts, for which the law was especially made, treated it with magnificent scorn and indifference. In 1862 a special session of the legislature was called, for the express purpose of enacting a law to enable our brave soldiers in the field to vote, and to adopt measures that would strengthen their hands and hearts, and give moral and material support to the government. It is humiliating to record, that the very first thing done when that body was convened was to introduce a bill to repeal the dog-law. And the law was repealed.

The history of this legislation is a remarkably curious and a very ludicrous and amusing one; and these few facts are detailed now, because the day is not distant when our farmers will again become clamorous for some such protection or will be a "law unto themselves" and will kill every dog that is found ten feet away from home. The following are some of the more potent objections to the law as expressed by many persons: it did not provide a fund to indemnify the owners of sheep from losses by the ravages of dogs; it was humiliating that our children should be educated by a dog-tax; it was unconstitutional, depriving a man of property without due process of law; if dogs were killed off, the wolves would so increase upon us that no domestic animals could be reared; it did not allow every farmer to have *one* dog free of taxation—and much more of that kind.

In Ohio, in 1863, there were 174,404 dogs. Sheep killed by dogs, 36,778; injured, 24,972. Value of sheep killed and injured, $136,347 28. The whole number of sheep 4,448,227, valued at $7,339,041. The entire population of the State, in 1860, 2,302,838—say, in round numbers, in 1864, 2,500,000. This would allow one dog to every 14 persons, and less than two sheep to the individual. Proportion of dogs to sheep as 1 to 26. The population of Iowa, in 1863, is 702,162; and taking the same ratio as obtains in Ohio, it will give a grand aggregate of 50,155 dogs in Iowa. There are not less than 900,000 sheep, or a little more than one sheep to the individual; and the proportion of dogs to sheep foots up the alarming ratio of 1 to 18. In Ohio each dog was nearly 80 cents damage to the flocks of the State; taking the same proportion, our losses in the past year will reach $40,124. In the absence of statistics, this may be considered a fair approximation. Scarcely a week passes but a newspaper paragraph gives intelligence of loss to sheep, by dogs, in some part of the State; and not a hundredth part of these ravages finds its way to the press. Says Colonel Johnson, secretary of the New York State Agricultural Society, (Trans. 1862, page 710,) "We have received, for the first time, the number of sheep killed by dogs—5,503 sheep in twenty-two counties, as reported, and from the remaining districts in those counties not returned would have increased the number to at least 8,000, and for the whole State probably 50,000; valued at present prices for sheep would make for the whole State at least $175,000. We ask the farmers of the State if they can afford to supply with choice mutton (sheep) these worthless curs roving over their fields every year."

From this showing it is evident that there was, and still remains, a necessity for legislation on this subject; and how much opposed soever the farmers, as a class, may be to the taxation of dogs, or to their destruction, the fact is patent that their losses are annually very great from this cause. Should a legislature

refuse to remove any other nuisance from which the agriculturists suffered half so much damage, they would very reasonably complain of a want of protection to their interests.

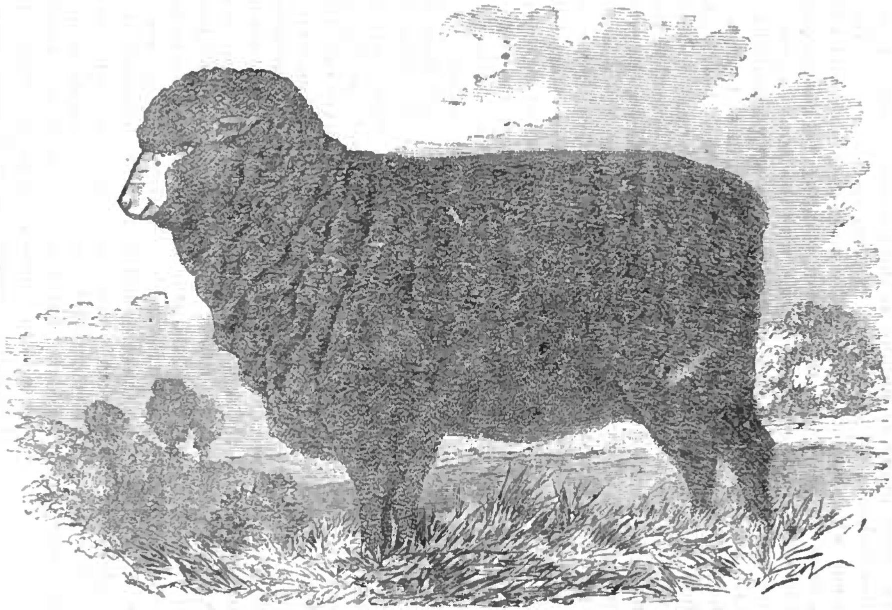
Says Governor Kirkwood, in his message, 1861, "This great interest of our State (agriculture) may, in my judgment, be aided by legislation in a new direction. Hitherto our great staples for export have been wheat, corn, cattle and hogs. The prices paid for their transportation to New York form a large portion of their value at that point. Indeed, wheat and corn will not bear transportation to that market during the season when the navigation of the lakes is closed. Experience has, I think, conclusively shown that our State is admirably adapted to sheep-grazing; and the value of wool in proportion to its bulk and weight is much greater, and the price of its transportation to New York in proportion to its value much less than that of our present staples. A great drawback upon the growing of wool is that large numbers of sheep are annually killed by dogs. I therefore recommend that a tax be levied on all dogs in the State, and that the proceeds of the tax be applied to paying to owners of sheep killed by dogs the value of the sheep thus killed. I would go further than this—I would exempt from taxation for a period of five years all sheep, not exceeding fifty, owned by any resident of the State, and would also exempt from taxation, for the same time, all capital invested in the State in the manufacture of woollen goods."

The former recommendation has already been fully considered; the latter, in the house of representatives, took the form of a bill; but it was defeated, and no exemption from taxation was made.

Shelter.—The want of adequate shelter is by some persons considered a serious impediment to the success of the wool-grower. The prairies are very extensive, and the cold winds of winter sweep over them with merciless energy—the heats of summer pour down upon them with parching violence. Warm and convenient sheep cotes in winter, and cool and refreshing shade in the hot months, are a most important auxiliary to success. Lambs must be carefully protected in the cold and wet days of early spring, and at every season there is necessity for some sort of protection against the vicissitudes of climate. Not every farmer is able to purchase lumber for sheds and folds; having paid for the land and indispensable improvements, and the effort to purchase stock being fairly made, the state of his finances will hardly ever allow him to make specific outlays in this direction. Railroad communications greatly reduced the price of pine lumber, within seventy-five miles of the Mississippi, until the p esent season, when, on account of the low stage of water, it was difficult to procure enough to supply the demand made for building, &c., and prices, even on the line of the roads, reached fabulous figures. To cut and carry to mill logs to be sawed is, on account of the distance to timber, a herculean task. When the house and fence, and some kind of outbuilding for horses are erected, the farmer is loth to add greatly to his building by this process. A rise in the river would greatly aid all persons in this respect. There are thousands of acres of logs cut in Wisconsin and ready to be floated down whenever the stage of water will render it admissible. The enormous prices of pine lumber cause a man to hesitate before he makes purchases that are not indispensable. This drawback is only temporary, and it is hoped the snow and rain of this winter will enable the lumbermen to supply all that may be demanded in the spring. Temporary sheds or pens constructed of rails and covered with brush and straw are of great utility, and may supply the place of better protection until circumstances enable the farmer to add elegance to use in the erection of buildings, furnished with troughs for grain, racks for hay, and all the appliances that insure economy in food, healthfulness, and comfort.

But there is another species of protection which will never fail, and which should be a part of every wool-grower's stock in trade. We allude to artificial

PLATE XXV.



MERINO EWE "PRAIRIE QUEEN."

Hammond Stock, bred and owned by J. B. Grinnell, Grinnell, Iowa.

groves of timber. These afford lumber, fuel, and protection from winds, and cool and refreshing shade. There are already planted and matured, and maturing, 8,361 acres of timber, mostly of locust, maple, cottonwood, and walnut, all which grow with great rapidity on the prairies. A few statements are introduced here to show with what facility a farmer can produce his own timber. Says Hon. O. Whittemore, of Jones county, "The prairie soil is will adapted to the growth of all the forest trees that are found in this latitude; and when transplanted upon the prairie flourish and grow more rapidly than trees planted upon the timber soil, and are sure to live if properly put out. The black locust, planted from the seed, grows as prolific as the Canada thistle. It makes in a short time timber sufficient for fence posts, ranking next the red cedar for durability. Black and white walnut grow rapidly upon the prairie, and will produce nuts from four to seven years from the time of planting. There is no improvement that can be made upon our open praries, with the same expense, that will so enhance the true value of a prairie residence as ornamental shade trees." Says Hon. Suel Foster, president of the Iowa Agricultural College, "Let us plant trees that we may have them to look upon for their beauty, to eat the fruit, sit in their shade and breathe their fragrance, to raise orchards, shade trees, and groves, to break the wind of the bleak prairies, to modify the climate and make it much more comfortable for man and beast, and for the great utility of the wood and timber. It is generally thought to be easier to raise an acre of timber on our prairie lands than it is to clear an acre of heavy timber of the timber country." Here is something tangible from the pen of Samuel Bower, of Benton county: "Now we have upon ten acres, at six feet apart, twelve thousand (black locust) trees, and at what cost? Two days gathering and cleaning seed, two dollars; two days sowing seed and preparing land, two dollars; two days hoeing the first season, two dollars; one day digging up trees, one dollar; half day with team hauling trees to planting ground, one dollar; eight days ploughing ten acres, sixteen dollars; ten days man and boy planting trees, fifteen dollars; fifteen days cultivating second season, twenty dollars; total cost, fifty-nine dollars." A further statement shows that ten acres of maple, producing thirty-six thousand rails, can be grown in ten years at a cost of sixty-two dollars and fifty cents. To persons living in a timbered country these long extracts may appear irrelevant; but to the wool-grower of Iowa the culture of artificial groves is a matter of prime importance, and those who live on a prairie will not fail to appreciate all that is written on the subject. Such groves insure shade in summer, protection in winter, and afford the means for dividing the large fields into conveniently sized pasture lots. Could strangers see the panting flocks and herds escape during the heat of the day to the cooling shade, or could they see them hiding from the chilling winds in the calm and still air of the grove, they could realize at once the necessity of such protection. Sheep, in order to flourish, *must have protection* from the elements; the lack of it in former years caused disease and deterioration, produced a fatal discouragement, and finally was a principal element in giving credence to the absurd and hurtful belief that Iowa was no wool-growing State. The pioneer removed from Pennsylvania or Ohio; he brought his flocks with him; he left behind him tame grasses, small pasture fields highly cultivated, "babbling brooks;" the cool shade of the woods, the sheep cote, built regardless of expense, and with wise reference to the health and comfort of his sheep. He reaches Iowa and finds acres of tall waving grass; no shade from sun or protection from cold. Of course his sheep deteriorate; naturally his flock would decrease; for there was no care bestowed upon it, such as had been practiced in the old home. Forgetting all the influences he had left, and not appreciating the deprivations to which his flock was being subjected, he rashly concluded that Iowa was no place for the wool-grower. Finding, also, a munificent return for his labor in grain-growing, converted into hogs and cattle, he remained satisfied with his full crib and broad acres, and

abandoned his dwindling flock. Had the pioneer possessed the advantages of shelter that he had at home, in spite of all other drawbacks, he might have rejoiced in the abundance of his success in raising sheep.

Pasturage and Grasses.—Intimately associated with the wool-growing interest is the subject of grass and pasturage. The prairies yield an abundant and highly nutritious pasture during the summer; and the same grass, properly cured, makes excellent food for winter. There are in Iowa unimproved lands of the farm 4,135,613 acres, besides some millions more acres not of the farm. The greater part of this is covered with a luxuriant growth of grass, that affords almost unlimited range for flocks and herds. There are also 224,187 acres of tame grass for mowing, and 70,565 acres for pasture. There were cut in 1862 from tame grasses 328,042 tons of hay, and from wild grass 633,420 tons of hay. This enormous yield of wild hay, which is agreed upon by all experience to furnish a most suitable article of food for sheep during winter, and our millions of acres of free pasturage, are convincing evidence of the less cost of raising and feeding sheep here than in the older States. All the large expense of fencing, seeding, manuring, ploughing, and cultivation is avoided, and a bountiful nature spontaneously offers us an immense provision for the wants of those animals dependent upon us. It will be seen that the average yield of hay per acre of tame grass is nearly one and a half ton. Much of our meadow is made by hauling out and scattering the debris of the hay-mow; much by simply throwing out barn-yard manure; very little by a systematic and scientific effort to make a good stand of grass. Should our fields reach the degree of perfection in cultivation that have been expended upon the farms at the far east by deep ploughing, under-draining, fertilizing, and careful pasturage of stock, this average can be readily doubled. In the more thickly settled portions of the State the timber and brush lands are fast losing their coarse wild grass, and the surface is covered with a magnificent growth of blue grass and white clover, adding much to the beauty of the face of the country, and affording free pasturage for thousands of grazing animals. That Iowa is especially adapted to grass-growing, a few statements may prove beyond controversy. Says M. W. Robinson, writing from Des Moines county, near the southern border, and detailing an experience of twenty-five years: "I have been of the opinion for many years that, for the amount of labor and expense in producing, cutting, curing, and putting into market, it (hay) pays better than any other crop;" and then proceeds with minute directions, that will, if carefully observed, insure a never-failing yield. Says T. Wardall, writing from Mitchell county, the extreme northern part of the State, in an admirable essay on tame grasses: "By our State agricultural reports we find the grass crop of 1858 to exceed in value the grain and corn crops by $500,000; and the grazing interest is rapidly growing in importance as a well-established branch of agriculture, which promises to yield better returns for the labor expended than raising wheat or corn." Another sentiment: "It is known by observing farmers that a flock of sheep improves a field so much by being pastured on it for one season up to its capacity as to render the effect visible for ten years; and fields put down to grass properly will fatten more cattle per acre when five years old than when but two, which shows conclusively that the quality of grass improves proportionately with the increased richness of the soil on which it grows; and this result is best secured by grazing." Reports from many persons indicate that a greater attention has been paid within the past five years to tame grasses than ever before; and in no case has there been a failure to succeed when an intelligent effort has been made. Says N. Hamilton, of Clayton county: "We find that grain-raising involves us in a heavy outlay for seed, labor, and costly machinery; that it also reduces the productiveness, and, consequently, the value of our land. * * Not so with the tame grasses. The outlay is comparatively light, while the income is almost as great per acre as

with wheat; and if fed on the farm, the land is rather gaining than losing in value." Evidences from all parts of the State cannot fail to satisfy the inquirer that Iowa is entirely adapted to grazing purposes; that there are less failures in grasses than in the other crops; that the prices of hay are remunerative; that their cultivation is not exhaustive to the soil; that it can and does form a considerable element of our wealth; and that there is little danger of putting down too much land in grass, to the exclusion of grains.

But there is still another source of supply of food for stock. There are 1,733,503 acres of corn, and 1,522,936 acres of wheat, oats, and rye, making an aggregate of over three millions of acres, which yield an enormous quantity of coarse food that is very little regarded. The blades and tops of corn, and the straw of other grains, if husbanded with anything like care, to say nothing of economy, would feed thousands of horses and cattle during the winter, and leave the finer, but not more nutritious, products of the grasses for sheep. It is the custom with most farmers to turn hogs and cattle upon the corn-fields when the corn is gathered, and frequently before it is gathered, and give them "indiscriminate loot." Straw is left to rot at the place where the stack was threshed, cattle allowed to have free access, or it is hauled out to fill up some unsightly gulch, or burned to get it out of the way. The unusually large importations of sheep, with the regular increase of the flock, cannot fail to compel amendment in this respect. The 331,162 acres of Hungarian meadow and pasture for 1862 will not afford food enough for our 900,000 sheep. Giving the whole crop, including wild grass, at 1,000,000 tons, and the cattle numbering 1,245,868, horses 275,697, mules 12,032, or total live stock 2,433,597, and the necessity for economy is tolerably apparent. The tame grasses, which flourish luxuriantly, even under careless methods of culture, can be made to yield still larger returns as the fields grow older by careful admixture of seeds suited to the varied soil, by fertilization and pasturage. And there will soon be necessity for this; for the wild grass of the prairie, once destroyed, cannot be reproduced. The breadth of surface must be enlarged; pasture lands must be increased; the immense fields of hundreds of acres must be subdivided into small and conveniently sized lots, for the purpose of frequent exchange of the flock, and then, indeed, will be added an important element in making Iowa the paradise of the wool-grower.

It may be interesting to introduce here some evidences of the increased attention now being paid to sheep in Iowa; and could the pioneer who proclaimed that this was no country for sheep look upon the picture, he would doubtless be astonished "with a great astonishment." The exhibitions of the State Agricultural Society should be the just representative of the progress of the State in arts and agriculture. Particularly is this the case in the stock department. Men attend agricultural fairs to witness improvements, to study new inventions, to purchase implements and animals, as well as to make an interchange of thought and opinion upon all subjects connected with agricultural development. The interest manifested in any one direction can be measured with tolerable accuracy by the attention paid to it at the fair; as one index, then, of progress, let it be mentioned that, in 1856, there were 22 entries of sheep; in 1857, 10 entries; in 1858, 23 entries; in 1859, 37 entries; in 1863, 78 entries; in 1864, 107 entries. The committees speak in the highest terms of the quality of the animals, and declare that the exhibition was creditable to the State, and promised that Iowa should soon be second to no other in this particular. In 1864, also, an entirely new class of "pure Spanish merino" was formed, in which a complete pedigree was required as a qualification for competition. The effect was to call out an exhibition of very superior animals, that was highly commended by all who witnessed it. Feeling the great importance of concerted action, the wool-growers of southeastern Iowa, early in 1864, formed themselves into an association, adopted a constitution, elected

officers, and it is now in the full tide of successful operation. It numbers among its members many of the prominent wool-growers of the State, and bids fair to accomplish much good. The specific object of the organization was to petition Congress to protect the American wool-grower by fixing a tariff on all foreign wools imported. This object being achieved, it is the design to meet at convenient times and places, and by lectures, addresses, and discussions, to develop the wool-growing interest, and give it permanency and importance. These efforts cannot fail of producing good fruit. Mind will be brought into contact with mind, experience compared with experience, and the association will be a centre of light and knowledge.

A greatly condensed statement of replies of correspondents in 1863 will exhibit, with much clearness, the actual condition of sheep-raising at that date. It would occupy too much space to compare them with notes of the year previous. Let it be said, in general terms, that those statements are generally not adverse to the idea that sheep are a profitable stock, or are receiving special attention.

Audubon county.—There is a lack of interest on the part of farmers in sheep-raising.

Adair.—No very large flocks; farmers working into them as fast as their means will admit. Sheep do unusually well, are healthy, and with proper care little loss need be anticipated.

Blackhawk.—Increased 200 per cent.

Cedar Valley, (a large district.)—Sheep do well; imported over 40,000. Two years ago shipped from Cedar Falls 1,000 pounds of wool, last year 32,000.

Central Iowa district.—Much attention being paid.

Clinton.—Large numbers being brought from eastern States; business yet in its infancy.

Des Moines.—A decided improvement over previous years.

Dubuque.—Are engaging attention of agriculturists; 20,000 in the county; fleeces average 4 pounds.

Fayette.—Our wants partially supplied by importation of fine-wooled sheep.

Floyd.—Sheep have been sadly neglected; of late, number has been largely augmented.

Harrison.—Farmers who have had capital have turned their attention to wool-growing, regardless of price, paying $5 per head.

Jackson.—Have been introduced in large numbers the past two years; considered good paying stock.

Jasper.—Farmers are turning attention to sheep; county well adapted to sheep-grazing.

Jefferson.—Exported 219 mutton sheep.

Lee.—Numbers at the fair fully demonstrated the interest in wool-growing.

Mahaska.—Sheep increased sixteen-tenths, with a vigorous effort to increase both in numbers and quality.

Marshall.—Large importations of sheep; sheep-raising cannot fail of being a great source of profit.

Muscatine.—Just beginning to receive the attention that properly belongs to them.

Page.—Sheep-raising daily growing in favor.

Polk.—Becoming more and more satisfied, every year, that this climate is well adapted to wool-growing; raising of sheep becoming a prominent branch of agriculture.

Pottawatomie.—Generally improving the stock and increasing the numbers.

Scott.—Many large flocks of sheep have been introduced the past year, and the profits arising therefrom pay the entire outlay in a very short time; a new woollen mill lately started.

Union Agricultural Society, (a district.)—Sheep are beginning to be introduced by the more wealthy and enterprising.

Union, (a district.)—Sheep business has assumed huge dimensions.

Washington.—Wool-growing is fast becoming an important branch of husbandry.

Wayne.—Majority of the farmers have sheep sufficient to raise wool for the use of their families.

These brief notes indicate that though the interest is a new one, our farmers have taken advanced ground in this important branch of husbandry.

WOOLLEN MANUFACTURES.

While the evidences are abundant that Iowa can produce sheep and wool, it is not less clear that she possesses every facility for manufacturing purposes. Thirty millions of acres of uncultivated lands at prices ranging from $2 to $5 per acre; a healthy, salubrious climate; a soil unsurpassed for richness and fertility, and the variety of its productions; free schools, with a school fund amply sufficient to educate every child in the State; energy in projecting and completing railroads; agriculture receiving the patronage of the State; founding an agricultural college that promises the most important results; unflinching and unconquerable loyalty to the union of these States against all treason and rebellion—these invite hundreds to forsake the sterile fields of the country and seek home and employment in our midst. Particularly at this time is there room for the capitalist to invest in manufacturing woollen goods. Under a very large portion of the State lie inexhaustible beds of coal that afford a cheap and convenient fuel. Each year develops more and more this important element of wealth. In 1862 there were raised 901,858 tons of coal, which, at a fair estimate, will be doubled in 1864. The further these mines are worked, the better improved the machinery and appliances for mining, the more profitable does the business become. The supply of wood is by no means exhausted, and situations upon streams would be surrounded with a supply for many years to come. Streams of water likewise afford good water-power sites in almost every county; and upon the prairies water is abundant, and can be readily obtained by digging. Enterprising business men could, at this time, secure a monopoly in every neighborhood. In 1860 the whole number of manufacturing establishments producing over $500 was 1,790, and number employed 6,587. The State census of 1862 gives the value of general manufactures of all kinds at $2,950,805. We need one or two woollen mills and carding factories in every county of Iowa, of five thousand inhabitants. Here is a field for investment that will yield a handsome profit to the enterprising and intelligent capitalist—an investment that will pay a better percentage than any kind of stocks now for sale. Two millions of dollars would not establish mills and factories enough to work up the raw material produced on our soil. Our mills do not at present supply a sufficient amount of woollen yarn to make our stockings. We must commence the manufacture of woollen goods, or must continue to export wool to the east. And what is the result? We pay the transportation to the seaboard; pay the wages in part of the hands employed in the factories; pay the expense of freight back in the shape of cloths or goods in exchange; pay the jobber and dealer; and assist all these to amass a fortune at our cost. Were factories established here we would save all this vast expenditure; we would secure a better article of clothing; we would add to our wealth by giving employment to hundreds of operatives; the hum of business would resound gratefully to our ears; and above all, we would have a never-failing market for our wool at our own price, independent of dictation by the seaboard, and independent, too, of those damaging fluctuations that have been so remarkable in the history of the wool trade. Industry, skill, thrift, are the certain elements of success. Put these in active operation, assisted by capital judiciously invested and economically controlled,

and Iowa can, in this regard, be independent of the world. Let the question be asked, what shall we do with our three million pounds of wool? The present need compels us to send it to the eastern manufacturer. If this be unavoidable now, it may not so continue forever. We should, with our facilities for growing wool and manufacturing, consume it all at home, and save the enormous tax of transportation and manufacture abroad. In 1860 there were in Iowa twenty-three establishments for the manufacture of woollen goods; capital invested, $109,000; pounds of wool, 265,200; number of hands employed, 131; annual product, $167,960, (being an increase of only $55,506 in ten years.) The yield of wool in 1863, according to estimates carefully made by Gen. W. D. Wilson, at three and a half pounds to the fleece, was 2,099,783 pounds, or more than seven and a half times as much as was manufactured in mills in 1860. The number of pounds consumed in private families is inconsiderable in proportion to the whole quantity. The largest bulk of it has been exported to fatten transportation agents, eastern manufacturers, jobbers, and dealers. The remedy is to induce capitalists to invest in mills and machinery for manufacturing woollens, and to return to the simplicity of the fathers, and make our own clothing, blankets, and woollen goods in our own houses, and by our own firesides. Is sheep-raising in Iowa profitable? It has been already demonstrated that shelter, through the growth of artificial groves and the cultivation of timber on the prairies, can be readily produced. It has also been shown that the soil is admirably suited to the cultivation of the different tame grasses and pasturage which are so important an element in the successful growing of sheep. It could be shown, by a like accumulation of evidence, that no country in the world can produce corn, oats, root crops, &c., so readily and cheaply as Iowa. No one now doubts the fact that the climate is equally favorable with other localities to this interest; and it remains to inquire, will sheep-growing pay? Can the farmer convert a part of his grain fields into pasture? Can he divide his farm by fencing? Can he incur the necessary expenses of stock, shelter, &c., and at the end of a year or a series of years receive his own with usury? Some may ask the question in this wise: Shall Iowa abandon her immense hog and cattle product, and embark in the general rearing of sheep? These questions may not be answered, without becoming obsure, unless some space be allowed for comparison and analysis. It is hoped that what is here introduced may not be considered irrelevant, for these subjects are difficult to exclude in taking a careful view of the whole subject. In 1863 the different railroads in the State carried out 68,976 cattle and 518,049 hogs for the eastern market; and these constitute but a small portion of the exports, to say nothing of that raised for home consumption. Thousands of hogs and many head of cattle are slaughtered and packed at the numerous large establishments in this State, and are exported in marketable shape. This is and has been an immense source of revenue to our people that is by no means to be despised. Though much of the product is consumed in the carrying trade by reason of its relative bulk and value, and we cannot control our own prices, but are subject to all the fluctuations of the eastern market, still these exports have made us comparatively rich, and given us the comforts of substantial prosperity. The production of cattle and hogs, therefore, must not be abandoned; nay, more, it must not be diminished. An enormous quantity can be profitably reared without in the least degree affecting the wool-growing interest. Think for a moment of the millions of acres of unimproved land on which cattle may graze and thrive without a dollar of expenditure on the part of the grower; remember the immense surface—almost ready prepared for the husbandman by the beneficent hand of nature—annually planted in the different cereals; the vast quantity of the product, with even exhaustive modes of cultivation; remember that these are and have been for years our principal articles of export, and let no man in Iowa commit the suicidal act of diminishing her product under any circumstances.

Durham and Devon cattle are not an experiment in Iowa; they have been tried and are not found wanting, as can be abundantly proven. Writes Mr. Day, of Van Buren county: "I will here say for the benefit of those unacquainted with the Durham cattle, that I have had, until the last two years, the native cattle kept together with my Durhams on the same feed, summer and winter, and the Durhams have shown as great hardiness as the natives have through heat and cold; and further, quite as great a portion of the Durham cows have proven to be good milkers as the native stock." I have sold steers of such crosses (half-bloods) at thirty months old, off of grass, at $35 per head, when the native stock steers were bought at the same time, and by the same dealers, at four years old, for $20 per head. Writes my friend, C. D. Bent, of Johnson county, speaking of their adaptation to this stock: "The Devons are a hardy race; their energy and perseverance make them well adapted to the rough forage of winter pasture, as it is termed, or ranging in the stock-field, and while so doing, and while ranging on the prairie, they are found to thrive faster, and do much better than the other cattle upon the same range." Now, if thorough-bred cattle, which are generally supposed to require more attention as to shelter, feeding, &c., will thus thrive, much more will the common stock of the country flourish and be a source of revenue. Iowa cannot afford to lose a particle of her attention to the rearing of cattle, but her farmers must put forth every effort to improve the stock, and largely increase the annual product.

Already it has been observed that sheep-growing has become a mania in some localities; farmers, stimulated by the high price of wool, investing all their surplus capital in sheep to the almost entire neglect of other branches of stock-raising. *Sheep will pay;* but shall we run into the astounding folly of excluding well-tried sources of profit in husbandry for the sake of one promised, and as yet untried? Sheep will pay; but it is under certain inflexible conditions to which the grower must yield. Horace wrote—

> Est modus in rebus; sunt certi denique fines,
> Quis ultra citraque, nequit consistere rectum—

and happy and blessed is the man who can escape the extremes where lie ruin and disaster, and steer the middle course where dwell certain success and prosperity. Men to-day are bringing thousands of sheep into the State who are not only but very poorly, if at all, prepared for them, but who are ignorant of the first principles of their management; know nothing of their diseases and remedies; know nothing about feeding, breeding, sheltering, shearing, or marketing. Can these reasonably expect large profits? The experience of the past is against the expectation. It might be that fortuitous circumstances may surround them, and they may succeed; but the success will not be the result of the careful application of sound knowledge and discretion, but a stumbling fate which could as readily have brought loss and ruin. A specialty, if it were possible to reduce our agricultural resources to one branch, would ruin us beyond redemption; and the idea is by no means to be tolerated. The fact is, (and we can scarcely refer to it too frequently,) our people have endeavored to make hogs and cattle the specialty of our agriculture, and the result has been that other interests, among them sheep, have been greatly neglected. But, on this account, shall sheep take precedence of other stock? Shall we embrace the other extreme? A word of caution may not be amiss here. "Festina lente." Hasten slowly is a maxim of incalculable value to all who are embarking extensively in sheep-raising. Sheep will pay if you are ready to expend labor, time, and money, accompanied by a sound knowledge of the wants of the animal, and the application of that knowledge to those wants. If not, you must expect losses and discouragements. Above all things avoid the hurtful idea that a large flock of sheep is all an Iowa farmer needs. Get the flock, but neglect not the herd.

We cannot forbear to further illustrate the hurtful effects of avoiding sheep

altogether in the past and giving entire attention to hogs and cattle; and like effects will follow if sheep are made a specialty. Why are so many farms barren of the orchard? Because fruit does not pay, and it is neglected for cattle and hogs. Why is not more flax cultivated, both for the seed and fibre? No time to attend to such small matters. Why does not every farmer keep some good milkers, and raise butter and cheese enough for his family and a large surplus to sell? Because he regards it as trifling business. Why is there no time for adorning the home with lawn and shrubbery; to beautify the farm with hedging and groves; to add to the comfort and insure the health by a vegetable and fruit garden? Because the hogs must be fed and the cattle cared for. Let the corn crop fail, and what recourse has the farmer? Nothing to fatten hogs and cattle, and he goes into market with indifferent stock. But a mixed agriculture cannot fail to return a magnificent percentage on the labor and capital invested. Corn, wheat, oats may be a short crop from unavoidable causes, but our grasses never fail when properly set. A dry summer may parch them; a wet season may cause a too rank and luxurious growth; but should this occur, the labor of seeding and all the expenses of putting in the crop are avoided. And the revenue from the pasture and meadow is almost absolutely certain. To illustrate: Asa C. Bowen, of Jones county, sold, in 1863, one thousand dollars' worth of cheese from thirty cows, mostly native stock, and only a portion of them first-class cows. How is this result? From the fact that he pastured nineteen head of cattle and three horses on thirty acres, and the feed was all that could be desired until after harvest; and this, too, in 1863, a year that will long be remembered for its drought, from which all the crops suffered. Thus the dairy is a source of profit; fine blooded cattle flourish and maintain their superiority; hogs bring in an abundant income. What supreme folly, then, to abandon or diminish the numbers of these, and launch forth upon a sea that, to very many, is unexplored. Let Iowa continue her productions in these directions, and let her rear sheep and grow wool as an additional profitable element of husbandry; let her people be getting ready more and more every year for this great work; let associations be formed to discuss experiences and compare results; let all the tame grasses be cultivated with assiduity; let men import the very finest blood of sheep; let every farmer determine to raise sheep as a part, and only a part, of his profession, and there is every reason to anticipate an abundant ultimate success. But if she abandons her present unfailing sources of income, and madly, blindly, and foolishly turn her exclusive attention to sheep, her people cannot fail to be discomfited, and the old story will be repeated—"Iowa is no place for sheep," and our civilization will be set back at least a half score of years.

This State is so new in its intelligent experiences of sheep-husbandry that reliable data are difficult to obtain. The exact effect of our peculiar climate on the fibre is not determined. The general fact of health and disease is not established. The wool-grower of Iowa has no past, for the earlier attempts are but a series of loss and discouragement. It is asserted by Hon. J. B. Grinnell, an accomplished scholar, and a man, perhaps, better versed in sheep on the prairies than any other in the northwest, that foot-rot will not abide with us; that flocks driven into this country with the disease recover from it without attention. This is a most encouraging statement. The other diseases mentioned by Mr. G. are attributed mostly to some species of mismanagement, and have nothing peculiar. Mr. H. B. Hoyt, of Fayette county, (to whom reference will be made again,) says: "Our flocks are subject to no disease; the scab, foot-rot, and grub in the head have never made their appearance in this locality; whether it is owing to the healthiness of our climate, or that no such disease has ever been contracted by our flocks, is a matter not thoroughly demonstrated." The early wool-growers lost many of their sheep by foot-rot. The family of Johnson Pierson brought with them from Virginia, in 1837, fifteen hundred

sheep; the disease decimated his flock, and so discouraged him that he abandoned the enterprise. Mr. Brownlee, at the same time, brought five thousand head from Pennsylvania, and had a similar experience. It will take a series of years and much recorded testimony to settle the questions now under consideration. No one can assert positively that there will not be necessity for the farmer to make occasional pilgrimages to Vermont to procure some different blood in order to preserve the fineness and other qualities of the flock.

COMPARATIVE PROFITS.

The following lengthy quotation from Mr. Hoyt will be read with interest:

"An estimate of the profits of sheep-raising could not be easier arrived at than by the usual custom of letting sheep in Iowa. Take, for example, one hundred head of ewes, to be let for one year—the owner to receive one-half the wool and one-half the increase, the original flock to be returned, and we have the following figures: 500 pounds of wool, at sixty cents per pound, $300; 80 lambs, at $2 50 per head, $200; total, $500; the owner's half, $250, which would be fifty per cent. on $500, a fair valuation for a flock of one hundred ewes.

"For a more accurate estimate on the profits of wool-growing, the writer has given below a true statement of his own flock of 300 Spanish merino sheep, the hay and grain estimated as accurately as possible without weighing; other figures are exact:

Forty tons of hay, at $5 per ton	$200 00
Five hundred bushels of oats, at 25 cents per bushel	125 00
One hundred bushels of corn, at 30 cents per bushel	30 00
Washing and shearing	20 00
Herding on prairie with another flock	40 00
Man feeding six months through winter	60 00
Interest on fifteen hundred dollars, value of flock	150 00
Total cost	625 00
Seventeen hundred and eighty-eight pounds of wool, at 63 cents	1,126 44
One hundred and eight lambs, worth $3 per head	324 00
	1,450 44
Less the cost	625 00
Total profit	825 44

In the report of the Commissioner of Agriculture for 1862 are found some interesting statements as to profits of sheep-raising. Reducing the number of ewes to the same as Mr. Hoyt's flock, we have the following:

Name.	Residence.	Kind of sheep.	Profit.
James E. Bonine	Vandalia, Michigan	Merinos	$1,103 44
W. H. Ladd	Richmond, Ohio	Silesian merinos	1,455 00
G. F. Quimby	West Salisbury, N. H.	Spanish merinos	309 00
Samuel McFarland	Washington, Pa	Saxon merinos	351 00
John S. Goe	Brownsville, Pa	Spanish merinos	3,042 00
J. B. Hoyt	West Union, Iowa	Spanish merinos	825 44
B. W. Couch	Warner, N. H	Atwood merinos	972 00

Number of pounds of wool by each person: Mr. Bonine, 1,822½ pounds; Mr. Ladd, 1,530 pounds; Mr. Quimby, 1,350 pounds; Mr. McFarland, 900 pounds; Mr. Goe, 1,650 pounds; Mr. Hoyt, 1,788 pounds; Mr. Couch, 1,800 pounds.

It would be superfluous to enlarge and comment on these figures. They speak for themselves, and make a record of which Iowa may be proud, and which speaks a word of encouragement to every man who has invested capital in sheep. It is hoped that other growers will follow the example of Mr. Hoyt, and preserve data, from which the profits of wool-growing may be determined with precision.

Thomas McGiffin, esq., president of the Wool-growers' Association of south-eastern Iowa, writes thus: "There is no such great art in the management of sheep that any man of ordinary capacity cannot become a good shepherd in a short time. Patience and good feeding have often done more for the animals than theories and experiments, though tried by intelligent men. A patient, quiet man will become rich by the side of a scientific gentleman, who can scarcely make his income meet his wants. Sheep will do well where the land is very flat, by having drains to lead off surface water. Wherever cattle and horses and hogs live and thrive, sheep also will live and thrive, and, taking any given number of years, will prove the most profitable to the owner. Sheep have done finely in Iowa the past year, notwithstanding the severe winter and the backward spring. My ewes yielded as much wool as in Washington county, Pennsylvania, and came from thence in the fall, out of short pasture, carried through, and with little time to recuperate before the cold set in. They raised eighty per cent. of lambs; and they are equal, in carcass and wool, to the average production of that famous sheep county. The wool has not been one particle injured by the change, and never will be, with judicious selections of bucks and prudent management. Whenever we have good tame grasses for spring and fall pasture, and plenty of tame hay to feed *under cover*, when the wind blows too keen for out-door foddering, and the necessary shelters, no portion of this land will raise better sheep or finer wool. If the sheep in the east received no more attention than some do here, their losses would be as great—in fact they are as great, to my own knowledge. The great trouble with almost all stock men west is the idea, that unless they move by the thousand they do not move at all, and, consequently, gather up all sorts of sheep in large flocks, herd them, and pound them to death. The same treatment would ruin all the flocks in the United States. Large droves have been brought into Iowa that were raised by the kindest of owners, under shelter of the best kind, and no sooner landed here than they are compelled to breast the storm of wind, rain, sleet, and snow, until nature can endure no more, and the poor things die, to leave their pelts, if the owner takes care of them, to pay for such bad treatment.

"What is to be done? Get material for some kind of shelter against the fiercer elements, and the milder ones will not hurt the flock. Divide your flocks, so that the weak can get a full, fair bite, without being run over by the strong. Keep cattle, colts, hogs, and mules *out* of the sheep houses and *in* their own, and many deaths, uncertain as to cause, but certain as to loss to the owner, will be very often prevented. When spring comes, do not turn the ewes out in the bleak prairie to lamb and the offspring to perish. No one has ever succeeded who neglects his flock, in any state or climate. Storms occur every-where at times, and kill as often in Vermont as in Iowa."

Wool traders have paid very good prices for "western wool," known heretofore as such from the amount of dirt, burrs, &c.; and the wool-grower is looking forward to still better prices for the coming clip. If it is well cleaned, there is no doubt but that his expectations will be realized; but eastern prices cannot be had until the sheep are kept on good sod or in well-littered shelter. The "unsightly" appearance complained of by the buyers is caused by the filthy pens and pounds, and often by the black water of the washing stream. Let western men learn how to keep sheep, through as many years of patience and devotion as eastern men, and they will gain equally in purse and reputation.

Let farmers sow more grass-seed, have more pasture and meadow, clean out the burrs, and make a good home market, and they cannot fail to become independent through their flocks. Then, again, the influence of sheep husbandry will soften down the rough points of the boys, make home attractive to them, and increase the desire for education, books, and the more gentle pleasures of life. Feed well, shelter well, have a well of patience as well as of water, and no man need fail of success in raising sheep in Iowa.

Thus in sheep-growing, as in every other branch of industry, "there can be no excellence without labor." Skill, management, energy, *preparedness*, are all required by the farmer in Iowa who ventures upon the raising of sheep.

FINE-WOOLED SHEEP.

BY WILLIAM R. SANFORD, OF ORWELL, VERMONT.

THE adaptation of Vermont to wool-growing, and the peculiar advantages which would accrue to the people of the State from its introduction, became apparent at an early day to its most enterprising farmers.

The first pure-blood merinos were brought into Vermont by the Honorable William Jarvis, of Weathersfield, this State, soon after his extensive importation of them from Spain, in 1810 and 1811. The history of this gentleman's flock has been too fully set forth in various publications to need repetition here; from it sprung various full-blood and grade flocks, which were scattered over the State.

I can well remember the first merino ram brought into my own neighborhood. He was small, and had short wool, which was very dark and crusty on its outer ends. So strong was the popular prejudice against him that one person gave notice to his owner that if he got into the lot with his (native) sheep, he would shoot him! But, after a few experiments, the tide turned strongly in favor of the merinos.

In 1823, Honorable Charles Rich and Leonard Bedell, of this county, (Addison,) purchased a flock of Paular merinos on Long Island. Their purity of blood was amply established, and they were the origin of a hardy and valuable family of sheep which still continues to be a favorite one in this State.

They were, as a general thing, eventually crossed more or less with Mr. Jarvis's stock, imparting to the latter greater compactness of constitution, and receiving from them, in return, some improvement in the fineness and evenness of the fleece.

When the Saxon sheep were imported into the United States they made their way into Vermont. Some pure-blood flocks of them were started, and they were very generally crossed with the pure-blood and grade merino flocks already among us.

The Saxon sheep produced incalculable injury in this State. They were unadapted to our rigorous climate. They yielded far less wool than the Paulars and Jarvis sheep, and it did not sell for enough more per pound to compensate for the difference in amount. Yet for a time a mania to obtain them was universal. Even Mr. Jarvis, induced, as he declared, by the flattering representations of the manufacturers yielded to that unfortunate epidemic and crossed most of his flock with them. But the "good time" promised by the manufacturers never came. The worthlessness of these feeble little sheep became apparent,

and also the fact that they had by crossing nearly ruined our older merinos. But very few flocks of the latter, and those mostly small ones, had escaped the contamination.

Under these circumstances many persons sold out their fine sheep and abandoned wool-growing altogether. Some tried the experiment of breeding the large mutton sheep. But this generally resulted in entire failure. Others began to cast about diligently to recover the pure "old-fashioned merinos," as they were then called. I was one of the first to commence this, having purchased, about 1830, of Messrs. Grant and Jennison, of Walpole, New Hampshire, twenty pure-blood old ewes bred by Mr. Jarvis from his Spanish stock. Messrs. Grant and Jennison procured them when lambs, and being anxious to breed only Saxon, were induced to make the sale. These gentlemen afterwards remarked to me that the sale of these ewes was the greatest mistake they had ever made in sheep-breeding, as they then lost their pure merino stock. Myron W. C. Wright, esq., and Loyal C. Remilee, of Shoreham, Prosper Elithorp, of Bridport, Jesse Hines, of Brandon, and, I think, Alfred Hall, of Wallingford, and some others, at different periods between 1830 and 1840, procured small flocks of Jarvis sheep bred from his old Spanish stock.

In 1844 Mr. Edwin Hammond, of Middlebury, who had been a breeder of the early merinos, and subsequently of the Saxon, purchased, in connexion with R. P. Hall, of Cornwall, thirty full-blood ewes and three rams of Stephen Atwood, of Woodbury, Connecticut. In 1845 Mr. Hammond purchased twenty-seven ewes (one equal third of his flock) and one ram of Mr. Atwood. In 1846 Messrs. Hammond and Hall purchased more sheep of Mr. Atwood, but I am not informed of the number.

In the fall of 1844 Mr. W. C. Wright bought of Mr. Atwood, at the New York State Fair, a full-blood merino ram, which he took home and immediately sold to P. Elithorp and L. C. Remilee. Charles B. Cook, of Charlotte, bought a small number of sheep of Mr. Atwood about the same time, but as to the number I am not informed.

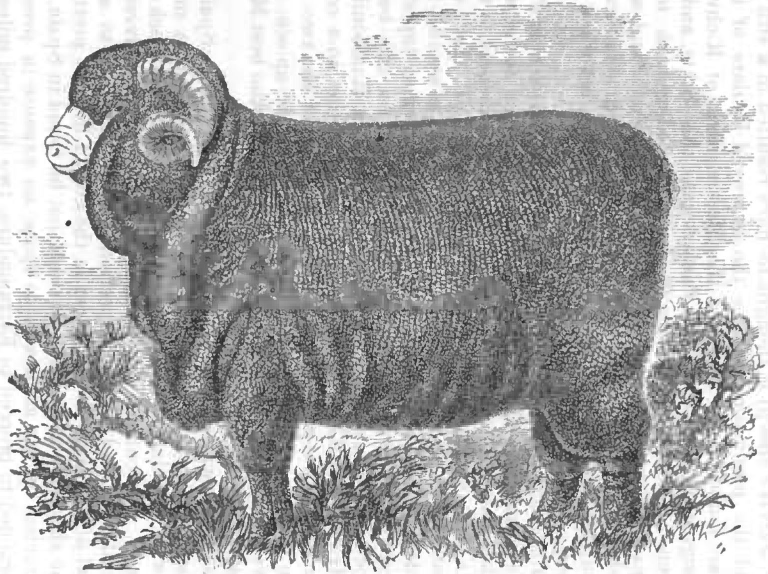
Mr. Atwood's sheep above-mentioned were pure-blood descendants of the merino flock imported from Spain in 1802 by Colonel David Humphreys, the American minister in that country. They are believed to have been of the Infantado family, and they were preserved from any admixture with other families by Colonel Humphreys, and by Mr. Atwood after his purchase, by breeding in and in, after the custom of Spain.

I continued breeding pure Jarvis sheep until 1849, using first a couple of rams from Mr. Jarvis, and subsequently those raised in the flock. In 1849 I purchased of Stephen and George Atwood the ram Old Black, (subsequently owned and used by M. Hammond, W. R. Remilee, and myself,) and thirteen ewes. In 1854 I bought of W. R. Remilee, of Middlebury, thirty-six ewes, (all of his yearling ewes and ewe lambs,) pure descendants of the stock bought by Messrs. Hammond and Hall of Mr. Atwood. Mr. Remilee had been a partner of Mr. Hall in those purchases of Mr. Atwood, and they, for a time, bred them together. To mark the change in prices since that period, I will state that my purchase of Mr. Atwood was at the rate of fifty dollars per head, and that my neighbors considered it an almost unheard-of price. The same year I bought seven yearlings and lambs of Abel P. Wooster, of Cornwall, which were got by the Wooster ram out of ewes purchased of Mr. Hammond.

Two or three years after commencing to breed Infantados, I found them superior to my old stock of Jarvis sheep and disposed of all the latter, and have bred my Infantados pure to this day. Mr. Hammond and all the leading breeders of this family of sheep in Vermont have never gone out of the original stock purchased of Mr. Atwood for rams, so that the family have been preserved absolutely distinct from all others.

The few pure Paular and Jarvis merinos left in the State in 1844, so far as I

PLATE XXVI.



MERINO RAM "COMET."

Five years old; bred and owned by Wm. R. Sanford, Orwell, Vt.; weight of fleece, 24½ lbs.

know their history, were generally crossed, more or less, with the Infantados after the introduction of the latter.

The cross thus made by several breeders by means of the ram which Judge Wright purchased of Mr. Atwood in 1844, and its results, are recorded in Mr. Randall's Practical Shepherd. Many details are omitted in this account of our Vermont merino flocks, as they have already been given to the public with great fullness by the last-named gentleman in the work cited, and also in his "Fine-wooled Husbandry." To the great accuracy and impartiality of his statements I can, after thirty years' observation and experience in the sheep husbandry of this State, personally bear witness.

This second cross of the Paulars with another family (the first having been made with Mr. Jarvis's sheep) is thought to have resulted in a still further improvement, and the produce constitutes the improved Paulars of the present day, as they are found in the flocks of the Messrs. Rich, of Richville, grandsons of the original introducer of the Paulars into this State, and of various other gentlemen. The stock has been formed by breeding back towards the Paular after each cross. They retain a distinctive character and are a hardy and valuable sheep. Some persons have mixed the different families indiscriminately and thus lost the distinctive traits of both families; but when judiciously bred these sheep, too, are valuable.

French merinos made their appearance in Vermont between 1840 and 1850 in considerable numbers. They attracted much notice and found warm admirers. In the last-named year the excitement ran high in respect to them.

In 1851 Mr. Hammond, Mr. William R. Remilee, R. P. Hall, and myself formed an association for the purpose of importing fine-wooled sheep from Europe, provided any could be found there which we esteemed superior to those already in Vermont. I was selected to go to Europe on this business, and reached France in February. I visited the royal flock at Rambouillet and the flocks of Mr. Gilbert and Cughnot, by common consent the most celebrated in France. I purchased twenty-three ewes and two rams of the two last-named gentlemen, the ewes costing $40 apiece, and the rams $150 apiece. The ewes were a good average of their flock, and I thought the rams the best Mr. Cughnot had, except two which he declined to sell that year.

Not being satisfied with the French sheep, I proceeded to Spain, reaching Madrid in March, where, through the kindness of the American minister, Mr. Barringer, I was introduced to some of the most prominent flock-masters of Spain, who were residents of the Spanish capital. From conversations had with these gentlemen, and by an inspection I was permitted to make of the wool of several of the large flocks stored in the city, I became pretty well convinced that the sheep I was in quest of could not be found in Spain. But having been instructed by my associates to spare no expense in prosecuting the search, I determined to proceed to Estramadura, two hundred miles distant, to examine some of the principal flocks of Spain, then in their winter pastures.

A Spanish gentleman, who was not only a large flock-master, but also a very extensive purchaser of wool, and acquainted with the best flocks of the country, through the kindly offices of Mr. Barringer, wrote to his mayoral, or head shepherd, who was in the habit of accompanying his master on his journeys to buy wool, and was very well acquainted with the reputation of each flock, to meet me in Estramadura and attend me on my tour of inspection. He accordingly met me with a servant, both mounted and armed to the teeth.

The travelling in Estramadura was in great state, in a cart closely resembling an American ox-cart, but rather lighter, with an awning sprung over it like an emigrant wagon, and no seat but a bundle of rags. This vehicle was drawn by three mules, one of them ridden by a postillion. The affair was not very tasty nor very comfortable, but it was the best to be had. I saw a number of flocks and examined them with sufficient care to form a satisfactory estimate of

their character. It was at once obvious that they were inferior to American merinos. They lacked greatly in uniformity, and were generally light-colored, compared with our sheep, though this was in part owing doubtless to the fact that they are sheltered in no part of the year. They were very bare of wool on the legs, belly, and somewhat so on the head, compared with the American merino of the present day. Their fleeces were obviously much lighter than those of the last-named sheep, and it is doubtful whether they would have weighed more than half as much, and the same conclusion was arrived at as when I examined the wool in Madrid. The wool was shorter than ours, not so thick, and, though fine on the shoulders and sides, it did not run as even over the whole body. They were small, rather long in the leg, narrow in the chest, and thin in the neck. On the whole, I regarded them as inferior sheep, and entertained no doubt that they had degenerated since the importations from these families into the United States by Colonel Humphreys, Mr. Jarvis, and others, in the earlier part of this century, and came to the conclusion that their blood had not been preserved pure. Indeed, the most intelligent Spaniards I conversed with admitted their degeneracy, and said it was occasioned by the confusion produced by the French invasions and the civil war, and that the standard flocks were broken up at that time, and had since disappeared. Some of them said they contemplated sending to Germany for rams to improve their sheep.

From Spain I proceeded to Germany, first visiting Stuttgard for the purpose of having an interview with Charles L. Fleichman, esq., the American consul there, who was German born, and had an intimate knowledge of the country and its flocks. Mr. F. kindly consented to accompany me during my examination of the German flocks. We first visited the agricultural school in Hohenheim. The sheep were small and fine, of the same type of the Saxon sheep already introduced into this country.

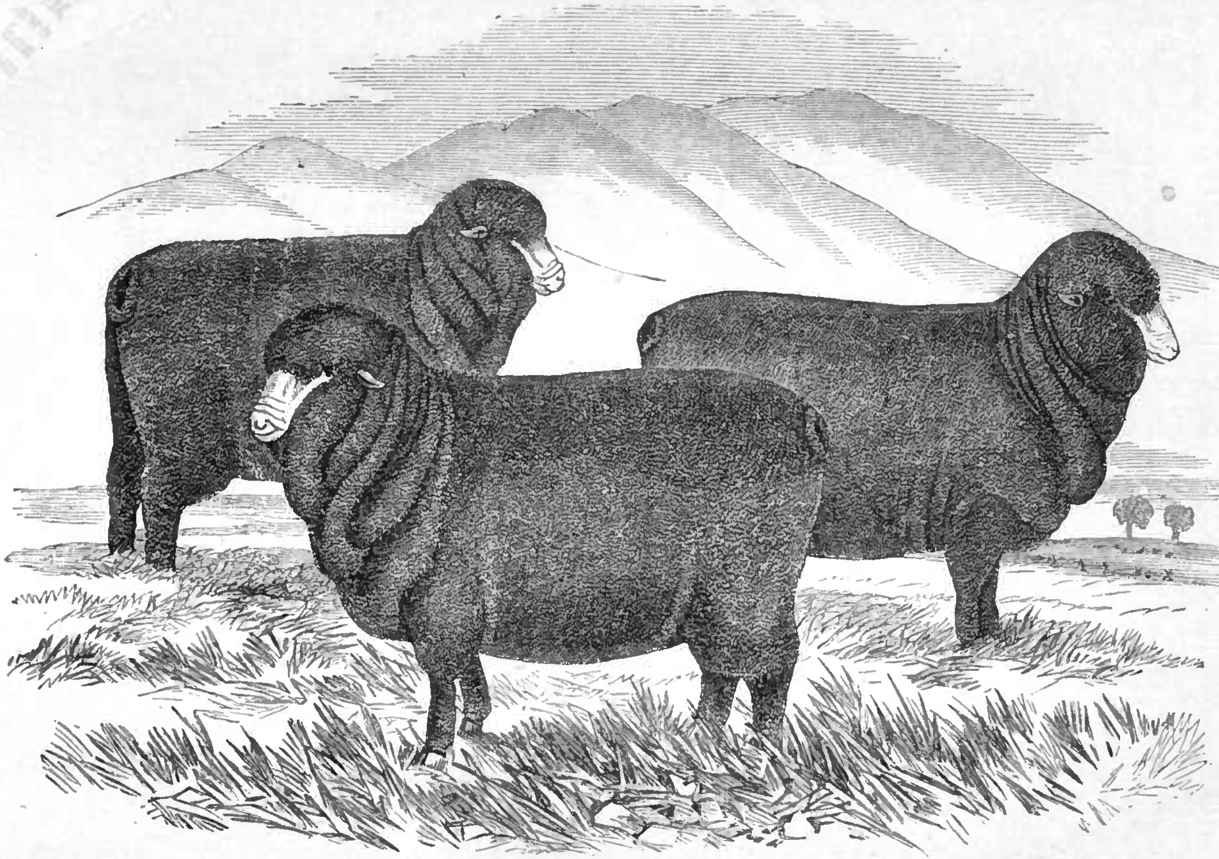
We then went direct to Saxony and examined many flocks. They were light-fleeced and exhibited marks of a delicate constitution. We next visited Silesia and saw many flocks, but found nothing desirable until we came to the flock of Louis Fischer, of Wirchenblatt. These were pure Spanish, having been imported from Spain in 1811. The father of Mr. Fischer brought from Spain one hundred Infantado ewes and four Nigretti rams, and these and their descendants had been held steadily together. I bought twenty-five ewes and six rams, a good average of the flock. They cost $17 a head. I made no further purchases in Germany or in Europe.

I did not for a moment suppose that the French or Silesian sheep bought by me were what I went to Europe for, viz: sheep superior to American merinos, but I concluded to take home a few, partly by way of experiment, and partly to recover, by selling them, the expenses of my journey.

On my return to Vermont, Mr. Hammond, Mr. Remilee, and myself, divided the imported sheep between us. We were all satisfied from the outset that it would not do to cross our American merinos with either of these foreign varieties; that nothing could be gained, and that a great deal would be inevitably lost by such a cross. Neither of us ever made a single cross with the French merinos. Mr. Hammond and myself each put an American merino ram to one Silesian ewe. He got a ram and I an ewe. They were not as good as American merinos, and we disposed of them. These were the only crosses ever made by any member of our association with any of the imported sheep.

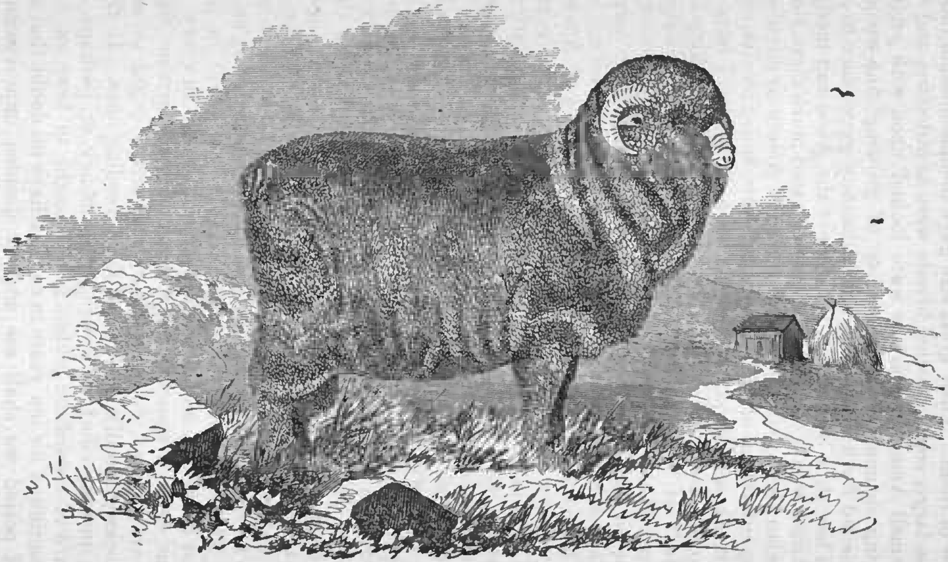
Our experiment with both families of foreign sheep resulted in failure. The French merinos sheared less wool, in proportion to size and consumption, than the American, and were less hardy. The same was true of the Silesian. They were a size smaller than American merinos, and the ewes sheared from four to six pounds and the rams from seven to eight pounds of unwashed wool. If not

Plate XXVII.



MERINO EWES.

PLATE XXVIII.



PAULAR RAM.

Bred and owned by J. H. Thomas, Orwell, Vt.

sheltered from rain their fleeces bleached out white. After keeping our foreign sheep two years, we were glad to sell out all of them.

I suppose our experience with French and Silesian merinos accorded with that of other Vermont breeders, for considerable stocks of them had also been introduced by other persons besides ourselves, and after a few years they all disappeared. Neither has an advocate left in this country. The French merino answered one good purpose in other States, if not in Vermont, and it is the only good I know of them. Their great size gave them admission into regions where none but the large, coarse-wooled breeds were kept before, and where the comparatively small American merinos were looked upon with prejudice and aversion. Having demonstrated the utility of growing fine-wooled sheep, they naturally incited further inquiries, and ultimately gave place to a better variety of them. They thus became the pioneers of the American merinos in localities where the latter would otherwise have penetrated much more slowly if at all.

The Silesian sheep bore finer wool than the American merinos, and when the fine-wool manufactories of the United States become extensive enough to compel buyers to make an adequate discrimination in prices, I have no doubt these sheep will prove a valuable addition to our stock. But taking the prices of the different kinds of wool as they have been since my recollection, and as they continue down to this day, and taking all other circumstances into consideration, there can be no reasonable doubt that the American merino surpasses all others in profitableness for the great body of American wool-growers.

While I have a high opinion of both of the families of American merinos—considering either superior to the merinos of any other country—my own preferences are for the Infantado, or Atwood sheep, as they are called by some. It is generally a little larger than the Paular, and the best flocks excel the best flocks of the Paular in weight of fleece.

The improvement of the American merino in fleece and form has been rapid within the last twenty years. There is no doubt that Mr. Atwood made a marked improvement, particularly in weight of fleece, on Colonel Humphrey's sheep, imported in 1807, provided the latter bore even a family resemblance to the merinos of Spain, as I saw them in 1851, and I think the improvement which has been made in Mr. Atwood's sheep since their introduction into Vermont, in 1844, is equal or greater than that made by him on the Spanish sheep. The staple has been lengthened without any diminution certainly in its thickness. The fleece covers the carcass better, and especially so on the belly, legs, and head. The sheep is larger, shorter in the bone, lower in proportion to its size, rounded in the rib, and more compact and stocky in every particular.

There has been a manifest improvement in our Vermont flocks within the past five years; indeed, every year's crop of lambs ought to, and in the best managed flocks generally does, excel the preceding ones. If the same experienced skill, untiring effort, and disregard of money, or, perhaps, I should rather say, disregard of *immediate* profits now brought to bear on our best flocks, should be continued for ten years to come, I have no doubt that at the end even of that brief period we shall see another decided improvement in our flocks. Their average then may be as high, in point of quality, as are the best animals now.

What I mean by a disregard of immediate profits is, that our best breeders do not sell those particular animals which are most essential to carry on the improvements of their flocks, though they may be offered what the world esteems most extravagant prices for them. Prices far higher than ever were before heard of in this or any other country, for fine-wooled sheep, have been in many cases offered and refused during the past season for single stock animals, which the proprietors considered necessary for themselves to keep up the most rapid improvement of their flocks. From five to ten thousand dollars have been refused for single rams and from one to two thousand for single ewes.

The effect of in-and-in breeding our sheep has been the theme of considerable public discussion. It is said to be proper to speak well of a bridge which has carried you safe over. The Spaniards never went out of the flock for rams. To this extent Colonel Humphrey's sheep, prior to their importation, had been bred in-and-in for centuries. Colonel Humphrey's and Mr. Atwood pursued the same course, and their breeding was still closer, as their flocks were smaller.

As already remarked, others as well as myself have continued this system in Vermont. There is not a flock of pure-bred Infantados in the State, (or elsewhere,) which is not closely bred. The pedigree of my stock ram Comet—a cut of which accompanies this article—is no more than an average example in this particular. He was got by Victor Wright's California, by Longwool, by Old Greasy, by Wooster, &c. The three last-named were bred by Mr. Hammond, and their pedigrees, which exhibit their affinities, will be found at page 121 of the Practical Shepherd. The dam of Wright's California was got by Wooster, above named; his dam a ewe from Mr. Atwood. The dam of Comet was got by Old Greasy, above named, &c., &c. Comet's third fleece, taken off this year, (one year's growth,) weighed $24\frac{3}{4}$ pounds; his carcass, after the removal of the fleece, would weigh about 115 pounds. I had the opportunity of testing the public appreciation of him and his get by disposing of twenty-three two-year old ewes last August for the sum of $15,000. These twenty-three ewes sheared last spring $12\frac{1}{4}$ pounds apiece of unwashed wool. exclusive of tags.

It will be seen that the in-and-in breeding of sheep does not hinder improvement, or induce degeneracy or decay. Indeed, I am well satisfied that an improvement embracing the essential feature of uniformity could not be carried on with anything like equal rapidity, if the breeder were compelled constantly to bring new blood into the flock to escape breeding between near relations.

The successful breeder must have a fixed and uniform standard of excellence, and pursue it with a single eye, and with the best *materials within his reach*, without regard to theories which experience proves to be false and worthless. He who looks at theories instead of facts, and who veers about, now using a ram of one stamp, and now of another, to escape some imaginary danger, will never climb high in this pursuit.

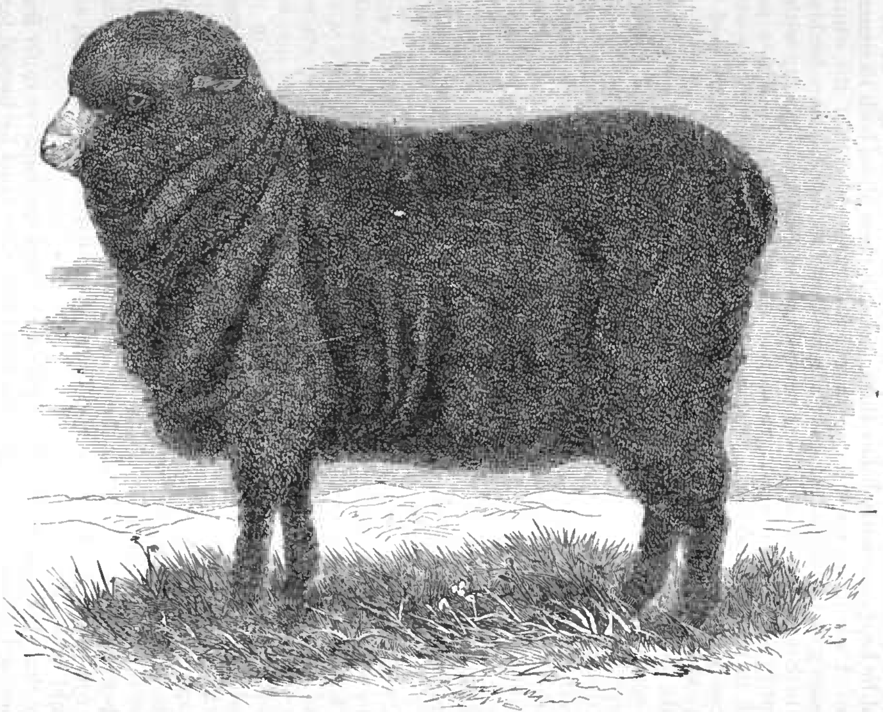
The attention of sheep-breeders is now called to a few leading points of practical management, and will begin with winter. It is always my aim to bring sheep into their winter quarters in good condition. To effect this, I feed sheep enough grain to prevent their dropping off in flesh after the grass has been rendered innutritious by fall frosts, keeping this up until they are brought into winter quarters and put on hay. There can be no greater mistake on the score of profit than to let sheep get poor, or even to losing condition just before the setting in of winter.

If they enter the winter plump and fleshy they are easily kept so; if they enter it thin or running down it is hard to give them a start in the opposite direction. Having got my sheep in good order on hay, I discontinue grain feed, except to rams, and sometimes to lambs if they are of good size and fleshy when they come into the sheds. I feed good hay, and do not keep over one hundred sheep together, and rarely as many as that. The lambs and yearlings are kept by themselves. I am particular to have the sheep feed about the same time each day.

My practice is to feed in box racks, and under cover when the weather is stormy and windy, my sheds and stables being so constructed that they can be closed and kept warm in cold weather, with sufficient ventilation, while they can be thrown open in pleasant weather.

Water is important to sheep in winter. They ought not to be compelled to travel far for it, because in severe and blustering weather they will go without it until they suffer, and when they do finally go they will drink to excess. Sheep drink often, and not much at a time, when they have convenient

PLATE XXIX.



PAULER EWE "COSSETTE."

Owned by John S. Delano, Mt. Vernon, Ohio.

access to water. I have observed the same sheep going to drink several times while eating a feed of hay, apparently relishing this mixing of solids and liquids as most men do at their meals.

In my own case I have the water brought into the sheds by means of pipes, so that the sheep can have constant access to it when they are shut in from storms.

Sheep, in my judgment, require exercise in winter as well as summer, and the want of this, combined with high keeping, is productive of injury and disease. Salt should be kept constantly before them, or fed to them often, both in summer and winter. I usually mix a little sulphur in it in the fore part of the winter.

I commence graining my breeding ewes from four to six weeks before lambing, according to circumstances, usually feeding corn and roots, beginning with a small quantity and increasing it gradually. After lambing I feed oats and shorts, with turnips or sugar beets, sometimes mixing corn or peas with the oats, in which case I have the grain ground. Oats are considered excellent feed to increase the flow of milk.

My lambs begin to drop about the 20th of March, preferring to have them come thus early, not only because they get a good deal more size and strength before winter, but because I can actually raise more of them, and at less trouble, than after the sheep are turned out on the pastures. I usually raise from 90 to 100 per cent. Lambs raised in sheds or stables are much tamer, and learning to eat a little from the racks and troughs, they will much more readily take hold of artificial feed when it becomes necessary to give it to them in the fall. I wean my lambs about the 20th of August, and aim thenceforth to give them the best of pasture, preferring the after-growth of meadows.

Washing sheep, in my opinion, is of no real utility, and, so far as it produces any effect, it is injurious both to the sheep and washer. It would have been done away with long ago, but for the rule which is practiced by buyers, and submitted to by sellers, of shrinking unwashed fleeces one-third. This rule may have been adopted when it operated fairly, but it certainly does not now when it is applied to wools clipped the first of May, before the yolk has started. Such wool weighs no more than it would if clipped in the middle of June, and washed as it is now fashionable to wash wool, *i. e.*, half wash it. Yet, in the former condition, it must be sold for one-third less. The wool-grower must submit to have this advantage taken of him or fall back into the old rut of late shearing. I regard early shearing as important for the benefit of the sheep.

Sheep sheared about the first of May have a growth of wool on them before hot weather sets in, which protects them from the flies and sun, and I think there is a better growth of it during the year than when it is sheared as the hot weather is commencing. They are also better protected from fall storms, and from the cold in winter.

It is true that sheep sheared in the beginning of May are liable to suffer from cold weather and storms in spring. To avoid this they must be housed for a few days, when it is necessary. They become safe from all danger in ten days or a fortnight.

There is nothing peculiar in my summer management of breeding ewes. I have their bags watched until they are dried off, keep them well salted, and keep a sharp lookout for fences and stray curs.

My sheep are not fed with grain after turning to pasture. I consider this an improper degree of pampering, tending to render the animal unfit to subsist and thrive on the food which nature made sufficient for its wants, nor do I believe in summer housing. I would, however, commence sheltering all my sheep from storms after the first of September, were my pastures convenient to my barns. As it is, I commence sheltering my lambs about the first of September, and my breeding ewes about the 20th of October, when I commence putting them to

rams. My rams are not permitted to run with the ewes during the coupling season, but are kept better fed and put singly. The lambs are stronger, and a valuable ram can thus be made to serve a much greater number of ewes. A good, vigorous one, neither too young nor too old, and properly managed, will serve a great number of ewes. There are a number of rams in this region which are now paying the interest on $50,000 each. Comet will pay that sum this year on ewes I have taken in for him to serve, outside my own flock.

Are such prices disproportioned to the object attained? So far from it, the owner of the ewes frequently gets lambs in this way which will sell for double or treble the value of their dams, and at an advance over the average of the flock, which would pay for the same service five or ten times over. He gets on one side the benefits of the latest improvements which have been made in merino sheep, and thus gains, perhaps, fifteen or twenty years in breeding.

The subject of the profits of wool production in the future in this country is of deep interest to those engaged in sheep husbandry. It is not to be denied that the present period is one of excitement and inflation in all that pertains to that husbandry. Other branches of industry are affected the same way and by the same causes. Those causes grow out of the great civil war now raging. The question then naturally arises, will wool production and prices fall back to their former amounts when the war is over? They cannot. The prices were kept down by foreign competition. Our northern farmers could not compete with the cheaper lands and labor of South America, or with English capital in Australia and South Africa, under tariffs which let in these foreign wools, so that they could still be sold in our markets at 14 or 15 cents a pound. The average price of all the wool imported into the United States in 1860 was 14 cents a pound. Henceforth this competition, if not put a stop to by the present tariff, will at least cease to be destructive, and the question of high or low tariff is no longer an open one before the American people. A revenue tariff adapted to our present and future circumstances must necessarily be high enough to afford adequate protection to all kinds of American industry.

Is it probable, under the present stimulus to wool-growing, that the business will be overdone in a few years? In 1863 the home product of wool in the loyal States was 77,413,070 pounds; imports, 64,433,760 pounds. The imports of woollens amounted to the value of between $24,000,000 and $25,000,000, exclusive of shoddy and of free wool from Canada, which probably exceeded $1,500,000 more.

The demand has unquestionably been greatly increased by the want of cotton, which want will be again supplied at some future day. But when we again have cotton, we again shall have the people of the rebellious States to supply with wool; and the rapid and steady increase of population in all the States will be continuous. In the opinion of the best informed persons, there is no prospect that the domestic supply of wool will equal the demand within the lives of the present generation.

Never before has there been a period of so much reasonable hope to the American wool-grower. His expectations now do not rest upon a tariff which another session of Congress may do away. They may be said to rest on the preservation of the public credit, for without a tariff high enough to give sufficient protection to all branches of American industry, the government cannot meet its necessary annual disbursements.

Every sheep-breeder, who possesses judgment and industry, may look forward for success in his calling, and there is room for tens of thousands more to embark in the business.

SHEEP-HUSBANDRY IN NEBRASKA.

BY D. J. M'CANN, NEBRASKA CITY.

THAT portion of Nebraska Territory adapted to the rearing of sheep is the eastern half, extending 225 miles north and south, and 200 miles east and west. There is a large region of country extending still further west, comprised between the 40th and 43d degrees north latitude, which will probably remain uninhabited by man, and those domestic animals which are wont to follow him in his progress towards the verge of civilization, for half a century yet to come. This large tract of country is worthless to the farmer or stock-grower, save in the valleys of the Platte, Republican, and a few smaller streams; and even in these valleys we find the grass of a quality too coarse and long to prove either palatable or nutritious to our different varieties of sheep.

The vast fields of rolling prairie or rocky ridges between the river valleys of this section produce but little save an abundant crop of cactus and weeds, the uses of which it would be difficult to determine. But in our more fertile region of 45,000 to 50,000 square miles west of the Missouri, watered by the *Niobrara*, the *Platte*, the *Republican*, and the many smaller streams emptying their waters into these and the Missouri, there is, we think, every inducement that dame Nature could hold out to the enterprising sheep-husbandman to "come and possess the land."

CLIMATE.

Lying nearly 1,500 miles from the nearest sea-coast, and north of the 40th degree north latitude, it must be evident to the observer that Nebraska is liable to greater extremes of heat and cold than those States of the same latitude bordering on the Atlantic. An isothermal line of 52 degrees, commencing, say, at or near the city of New York, will be observed to pass through southern Pennsylvania, middle Ohio, Indiana, Illinois, southern Iowa, and through Nebraska, south of the Platte river, and near Nebraska City.

The elevation above the sea level is from 1,225 feet at Nebraska City, on the Missouri, to 2,360 feet at Fort Kearney, 175 miles further west. The mean temperature near the river is about 50 degrees, while the average annual fall of rain does not exceed 28 inches, and of this the most by far in the winter and spring. The atmosphere is thin, cool, and dry. The summer and autumn are usually characterized by what our farmers denominate "a want of rain;" and this "want" is generally experienced till December, and often dry winds and dusty garments greet the new year. As we write, (November 22,) a citizen largely engaged in sheep-raising informs us that his sheep still graze at large, attended only by a boy to protect them from wolves and dogs—the latter much more destructive than the former. He thinks his flock is doing much better on grass than they would on dry feed.

We think there can be but one objection to the climate of Nebraska as a sheep-growing region, and this is found in the fact that we are liable to experience cold northeast winds in the winter, rendering it necessary to provide more ample shed-room than in more eastern localities of the same mean annual temperature.

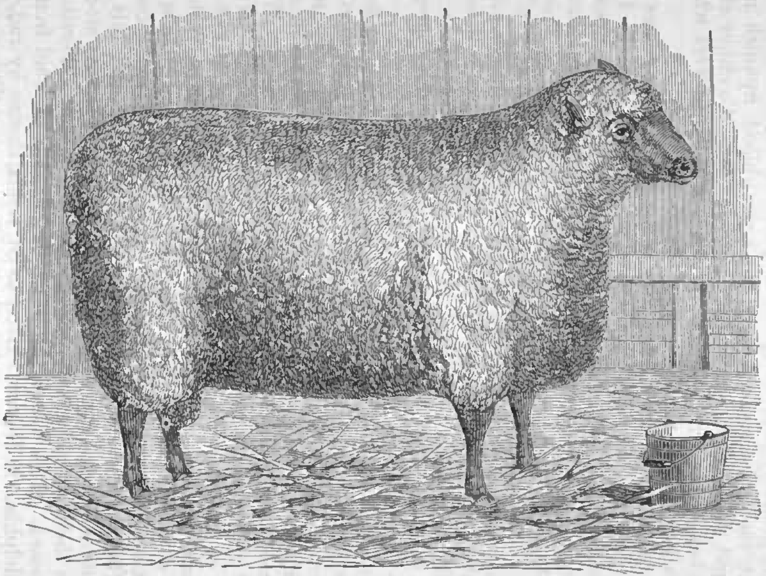
SOIL.

Our soil is a rich prairie loam, free from sand; clay is seldom, if ever, found, save in the immediate vicinity of a few small streams. A characteristic of this soil is its ability to withstand continued drought, as well as frequent heavy rains. The farmer is not often disappointed; in fact, we believe a good average crop of coarse grain has been realized every year since the organization of the Territory. The native prairie grass is found to be nutritious, and sheep fatten upon it as readily, we think, as on the different grasses of eastern States. But should it be objected that this prairie grass soon disappears where flocks are herded for any great length of time, we reply that our soil is peculiarly adapted to the blue grass, red-top and white clover. We have noticed large fields of these grasses in Nebraska, and believe they may be profitably grown. As a matter of economy, however, we recommend the raising of Hungarian grass and corn for winter feed. The rich oleaginous seed of the Hungarian is better than oats or corn, and imparts its oil to the fleece. The straw, if not too ripe when cut, is equal to the brightest oat straw, while two crops may be grown on the land in one season. Corn is most economically fed on the stalk, but we do not approve this economy. The weak members of the flock and the lambs are not rapid "shellers," and do not, therefore, secure the amount of grain they are entitled to, while, if slightly over-fed, they are apt to leave ears which are thickly covered with the husk untouched. We prefer feeding corn-stalks during cold weather as a coarse food, and corn in the ear twice per day. We find a change from prairie grass to corn-stalks, again to Hungarian, and again to sheaf-oats, to be advisable; and the observant shepherd will not be at a loss to decide when such changes should be made. We hear many cautions against "over-feeding." We are of the opinion that too many fears are entertained in regard to this point. Sheep, if fed regularly and plentifully, are not apt to eat more than *enough*, nor more than is profitable to the husbandman. Feed *judiciously*, but feed *freely*. Both the fleece and the carcass will repay you.

BREEDS OF SHEEP.

Located, as we are, remote from any large city, and not enjoying the facilities of railroads in shipping stock to market, we deem it unnecessary to discuss the question as to whether it is expedient to raise what are termed the mutton-breeds of sheep in Nebraska. Ten years hence we may decide to rear sheep both for wool and the carcass, but at present we must seek those breeds which produce the greatest number of pounds of that wool which will sell for the most money. The common coarse wools which have been driven from Missouri and Kentucky are poor shearers, indifferent mutton-sheep, and are altogether unprofitable to the farmer. But two breeds seem to be in favor in our Territory—the Spanish and French merinos. It is urged by some that the French are larger, a better mutton-sheep, and that as shearers they are equal to the Spanish; by others, that the Spanish are stronger in constitution and yield a heavier fleece of *better* wool. We regret there are not more of both classes of *pure blood* in our Territory, and that so little attention is devoted to the *weight* and *quality* of the fleece. After careful inquiry, and from our own experience, we are led to the conclusion that the Spanish are entitled to the preference, both because they are more hardy and the wool is of superior quality. Many, however, will prefer crossing their French ewes with Spanish rams of pure blood; and the cross, we are free to admit, is an excellent one in many respects. The size is increased, there is a larger staple, with less yolk or gum to be extracted in cleansing. The most important object to be attained, however, with us, (and it is one of prime importance to every sheep-husbandman who desires to sell fine wool, so as to realize the greatest profit,) is to secure pure-blooded

Plate XXX.



SOUTHDOWN "SON OF ARCHBISHOP."

Owned by H. G. White, South Framingham, Mass.

Spanish merino rams. We can obtain these only by paying what to western men seem exorbitant prices. The only safe plan to adopt to procure good blood, at the least expense, is to order such a ram as is desired of some breeder of established reputation, the excellence of whose stock has been proved. The writer has two Vermont Spanish merino rams, one of which he values highly, and which promises to make one of the best sheep, both as to constitution and weight of fleece, in the western country. He hazards but little in pronouncing him the best west of the Mississippi river. This ram is from the flock of Nathan Cushing, Woodstock, Vermont. Mr. Edwin Hammond, of Middlebury, Vermont, probably has sheep of as pure blood as any in the United States, and the man who sends to him for a pure-blood Spanish merino ram may rest assured that he will get what he bargains for. To either of the above gentlemen we beg leave to recommend our western wool-growers who desire to increase the value of their flocks.

During the continuance of the present war the price of the coarse wools will rule high. Upon the return of peace fine wools will advance in price, or coarse wools somewhat decline, till they have reached their proper level. It therefore behooves the western farmer to prepare for the demand he may reasonably anticipate a year or two hence. But if a pound of fine wool will command no higher price in eastern markets than a pound of coarse, is it, nevertheless, not the interest of the farmer to produce the fine in preference to the coarse? We think it is, decidedly. Every scientific man will testify to the fact that the fabric wrought of fine wool confines more caloric than that manufactured from the coarser material; and what manufacturer or consumer would not prefer the fine staple?

But another argument in favor of the fine wool breeds of sheep for Nebraska is the fact that they produce at least one-third more in weight than the coarse. The writer found that his flock of merinos averaged 5¾ pounds after having been driven from Ohio the previous season, while his coarse wools sheared but 3½ pounds, though they had been in the Territory two seasons. We now estimate the next clip to favor the merinos in the ratio of 2 to 1. Whenever we find the price of fine wool in the eastern market exceeding that of the coarse, the cost of carriage adds another inducement, to those already mentioned, to the farmer to choose the breeds which yield the fine staple. He will find that the transportation of 100 pounds of fine wool, worth, say, $100, costs no more than that of 100 pounds of coarse, worth, perhaps, $60. And this question of the transportation of wool compared with that of grain or live stock is an important one to the farmers in Nebraska and those States and Territories remote from the seaboard. The writer shipped 2,000 pounds of wool from Nebraska City to Philadelphia, via Missouri river, to St. Louis, thence by rail, at a cost of $56, or, say, three cents per pound, including insurance. This wool was worth in Philadelphia $1 per pound. What would have been the cost of shipping and insurance of any other product of the farm worth the same amount of money? We ask the careful attention of western farmers to this subject; it is one the great importance of which they have failed to realize. To all we would say, let your farms be the homes of "flocks" as well as that of "herds." If you have the coarse wools, *keep them;* if you have not the fine wools, *get them* as speedily as possible. Purchase pure bred Spanish merino rams, and soon we will have flocks which will compare favorably with any on our continent.

SPANISH MERINOS AND THEIR MANAGEMENT.

BY HENRY BOYNTON, WOODSTOCK, VERMONT, CORRESPONDING SECRETARY VERMONT STATE AGRICULTURAL SOCIETY.

BUT a little more than fifty years ago the first pair of Spanish merinos ever introduced into this country were brought to Cambridge, Massachusetts. So little knowledge of their value had the man into whose hands they came, that they were butchered and eaten. Now, two or three thousand dollars for a single ram, and as many hundreds for a ewe, of this same breed of animals, is no unusual price. Such has been the change in the public estimation of this class of sheep, in little more than a half century. And the man who should now be found feasting upon thorough-bred Spanish mutton would be classed as a near relation of the woman in the fable, who killed the goose that laid the golden egg. Indeed, such is the zeal now displayed by the devotees of this famous stock, that it is a matter of serious question with some, whether, at this day of almost universal intelligence, when nearly every one knows something of almost every subject that comes before the public mind, these men, "gone crazy" on the sheep question, show wisdom much in advance of the ancient Greeks in their mystic age of fable, with their belief in the existence of a ram which bore a golden fleece.

There have always been some men like the narrow-minded John Randolph, who have been ready at all times "to go a mile to kick a sheep;" yet in every age, from the earliest beginning of civilization to the present day, sheep have always held a high place in the estimation of those best qualified to judge of the sources of a nation's wealth, and it should be a matter of sincere congratulation to the American people that the subject of sheep husbandry is receiving such earnest and intelligent attention. Some things each generation must learn for itself, and one of them is the fact that the sheep is as necessary a companion for man now as in the more nomadic condition of the race, when Laban kept his flocks, or the angels sang their song of joy around the shepherd on the plains of Palestine. So true is this, that a history of the attention paid to sheep husbandry in any nation forms no inconsiderable means of judging of that nation's progress in wealth and civilization.

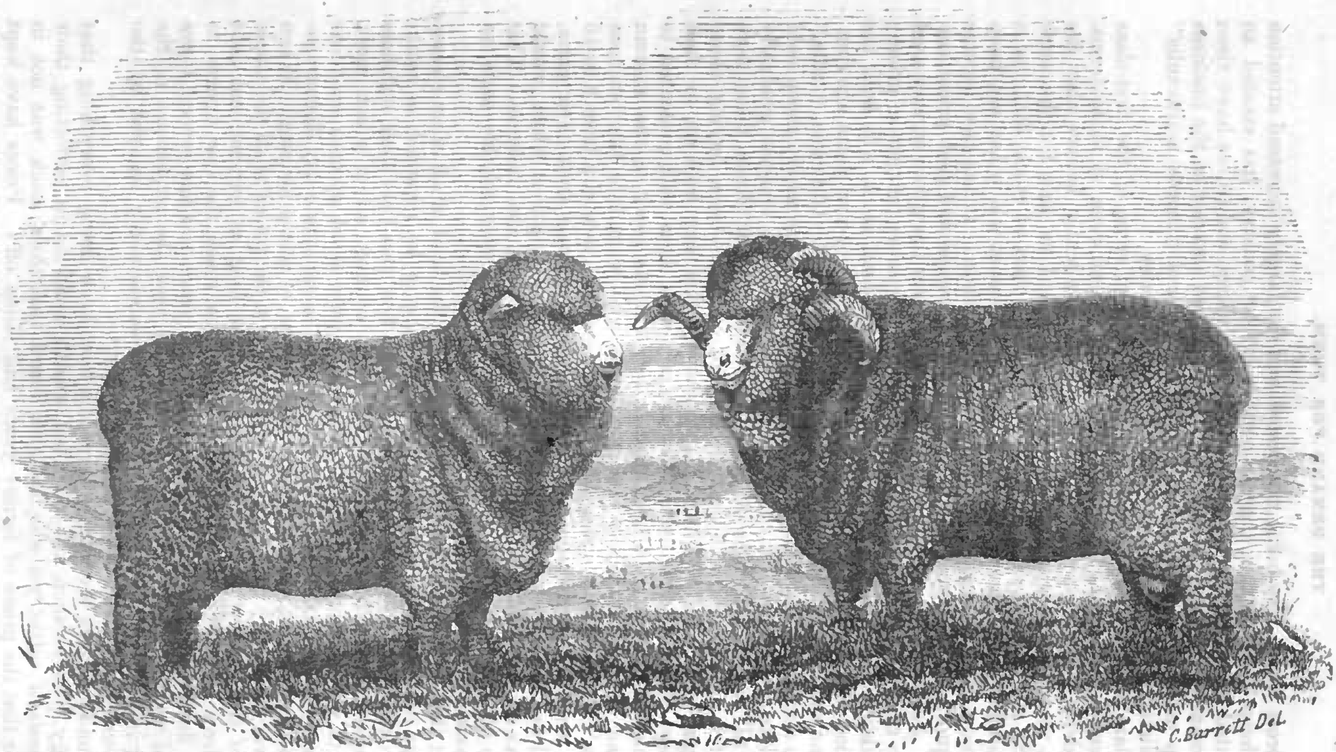
THEIR ANTIQUITY.

It is a significant fact that an authentic history of the Spanish merino reaches back for a period of nearly two thousand years.

The fine, rich fabrics worn by the Roman officials in the early days of the Christian era, and which found their way to the courts of most of the nations lying along the shores of the Mediterranean sea, were made from the wool of the flocks which grazed on the plains of Truditania, in Spain.

Through all the political convulsions which have harassed that country, which has given them their name, through all its conquests and reconquests, this race of animals has sustained itself. It has suffered transportation across the seas, endured the rigors of a cold country, stood the test of acclimation, taken even firmer and deeper root in our soil than it had in the sunny plains of its native Spain, and recently, through the skill and energy of a Vermont gentleman, has proved, at the international exhibition at Hamburg, that the American production of the Spanish merino stands at the head of all other sheep of the world.

PLATE XXXI.



SPANISH MERINOS.

Bred and owned by Nathan Cushing and Henry Boynton, Woodstock, Vermont.

THE DEMAND FOR THEM.

The interest that is now being manifested, and the largely increased attention given to sheep husbandry, in a great portion of our country, has created an unprecedented demand for thorough-bred Spanish sheep, and prices have risen with the demand, till many call the present awakened interest in the business the "sheep mania," and hint of the "hen fever" and "morus multicaulis" times, predicting that the same fate awaits this enterprise.

Ten dollars per head is now paid for the service of some of the first-class rams in Vermont, and hundreds of applicants are refused even at these terms. Some breeders, not over-enthusiastic men either, confidently believe that the time is not very distant when one hundred dollars will be paid for the same service. So great has been the demand for this class of stock that not a thorough-bred flock can be found in the State of Vermont which has not been reduced below the number its owner has chosen to retain. It has now become a serious question with many men whether such a demand and such prices can continue. As to all other branches of business, the war has given an increased stimulus to that of sheep husbandry, resulting in a temporary inflation of prices; but when this stimulus has become abated, thorough-bred stock will hold the same relation to all other classes that it does now. Thirty-five years ago first-class merino rams could be bought for ten dollars per head. Old ewes, "culls," sold in the autumn for three dollars per head. At this time native sheep sold for one dollar and twenty-five cents. As the prices of the merinos gradually ncreased, till culls sold for five dollars and an extra ram for fifteen. there were plenty of men who said such prices could not continue—men buying sheep at such figures must fail. The wise prophets of that day held on to their native sheep, and in many instances are holding on to them still, contented to clip 4 pounds of wool per head, and to sell their surplus stock in the autumn at three and four dollars, while their neighbors, who went into the "ruinous speculation" of fine-wooled sheep twenty-five years ago, now clip from 8 to 10 pounds of wool from their ewes, and from 15 to 25 pounds from their rams, and sell all the stock they will let go from their flocks at prices which would severely tax the credulity of a man not acquainted with the business. This xperience of the last quarter of a century will form a very reliable basis on which to base a calculation relative to the future.

The fact that the Spanish merino now stands at the head of all other classes f sheep, as regards quantity and quality of wool, may be regarded as established beyond all question, and when we consider how small are their numbers when compared with the "native flocks" of the country, all of which must, from year to year, be improved by an infusion of pure-blood, no man need fear that the demand for this stock will so far abate as to constitute any discouragement to those who wish to engage in the business of sheep-keeping. When ur civil war shall have been finished, a reduction in the prices of all the staple roducts of the country may be expected; but so long as our national debt hall require a high protective tariff, wool can never reach the low figures to which the fluctuating legislation of the country in years past has several times ent it, and we may safely predict that what has been the experience of the English breeders of pure-blooded cattle will be substantially enjoyed by the ock-masters of pure-bred sheep in this country.

For a hundred years the English breeders have been doing everything that kill, energy, perseverance, and unlimited wealth could do in perfecting their mous breeds of cattle, yet who has ever heard that their stock was not in emand, or that the prices of former years had fallen off? Prices have kept breast with their improvement from year to year, till 400 and 500 guineas is o uncommon sum paid for a single animal.

But there are other considerations which may strengthen the faith of th wavering and encourage the hearts of the doubting. When the cotton-growin States of the south produced three hundred and fifty thousand bales in a singl year, men of foresight and sagacity hesitated about making further investment in *cotton lands* and negroes, through the fear that the markets of the worl could never demand more of this article than was already produced. But fron that three hundred and fifty thousand the country went on producing till th yield reached six million bales, and yet the markets were not glutted, an cotton-growing was one of the most profitable branches of industry in th country. The condition of cotton-growing in those days when men wer doubtful of its future was not unlike the present condition of the wool-growin business. It is just in its infancy, and men need not trouble themselves wit forebodings of such times as were experienced under the tariff of 1841, whic sent fine wool down to 34 cents per pound. But all this might be reasonabl predicted even on the supposition that our population would make only a nomi nal increase for a series of years. But this country is now about entering on new era. Once through with our war, and a career of greatness and expansio is open to us which will call into the fullest activity every department of in dustry. While we look only to the production of so much wool as will b needed to meet the demands of our own people, we shall see that the fiel which is open to the American shepherd is a large one, and not likely to b fully occupied for many long years.

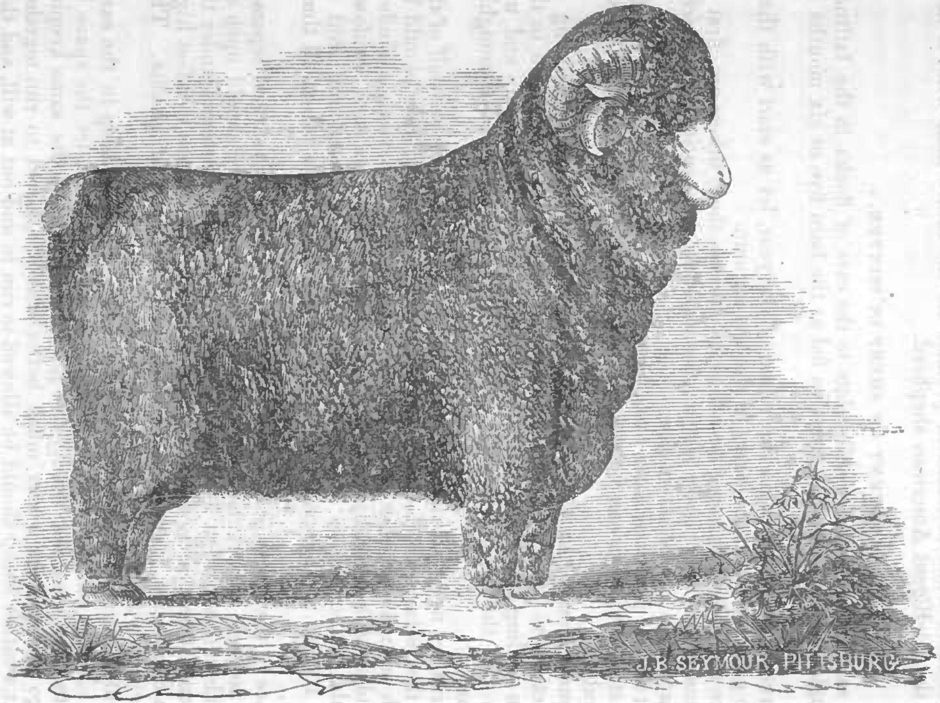
In 1860, there were about 23 million sheep in the United States, whic yielded in round numbers 60 million pounds of wool. In the same year w consumed about four and one-half pounds of wool to each individual, making total of about 120 million pounds, or twice as much as we produced. Let, the our population remain stationary, and we must double our wool clip before w can clothe ourselves.

But among the many lessons the present war has taught us, not the least this: the superior sanitary properties of woollen fabrics. As a matter of nece sity we have begun to reduce this teaching to practice, and so well satisfied a we of the adaptation of woollen goods to the varying conditions of our climat that in the future there must be a largely increased demand of the raw materi to meet the necessities of the rapidly multiplying varieties of manufacture articles. If before the war it required four pounds of wool to clothe each ind vidual in the country, the present reform in dress fabrics will prepare us her after to use at least six pounds. This amount added to what we consumed i 1860 would make about 160 million pounds, or about three times as much we then produced.

But no man is so short-sighted as to suppose that our population is to rema stationary, or that it is to be augmented only by the natural ratio of increas From 1850 to 1860 our rate of increase was three per cent. per annum. Su posing, then, that for the next thirty years our population shall multiply in t same ratio, we shall have within the present limits of the United States n less than 75 millions of people.

Admitting, according to the above estimate, that each individual will consun six pounds, it will then require 450 million pounds of wool to fit up our n tional wardrobe every year, or about seven and one-half times as much as t clip of 1860.

Now, put by the side of these facts one other, namely, that when a go merino ram is crossed upon a flock of common ewes, the progeny will show increase of from one-half to three-fourths of a pound per head; and when v remember to how great an extent the demands of the market must be suppli by the "native" or common sheep of the country, the question of the futu demand for thorough-bred Spanish merinos may be considered as settled beyo a doubt.



Improved Spanish Merino Ram "Crape Defiance," in full fleece, three years of age. Weight of fleece, 20 pounds; weight of carcass, shorn, 110 pounds; bred by Edwin Hammond, of Vermont; dam one of six ewes purchased by George Campbell from Mr. Hammond, in winter of '61 and '62, and purchased of Mr. Campbell a lamb, in September, 1862, by his present owners, Glenn and Brothers, Noblestown, Allegheny County, Pa.

Still there is one other point which should not be lost sight of in connexion with this matter. American wool can be made to compete with that of other countries even in their own markets. We shall never be satisfied with simply clothing ourselves. When the fertile prairies of the west, the immense domain of the great northwest, with the magnificent plains of Missouri and Kansas, and the region stretching on the west of the Mississippi, down to the Gulf of Mexico, shall have become stocked with sheep, the United States will take the same rank as a wool-growing country that she has heretofore held in the production of cotton.

No field is there wider or richer in promise for the future than what is here opened for the intelligent American shepherd.

MANAGEMENT OF SHEEP IN WINTER.

What is said on this subject will relate to the care of flocks in the latitude of New England, or where sheep must be fed at the barn five or six months in the year.

As a convenient point to begin the round of the year, let us start with them as they are gathered about the barns in the late autumn.

To insure successful wintering for a flock of merinos, these things are, first of all, indispensable, namely: *good shelter, food sufficient in quantity and variety, running water*, and *skilful attendance*.

The best shelter is a good bank barn, located on a dry soil, facing the south, and so constructed that it can be closed in on all sides by windows and doors, when desirable.

The ground around the barn should slope gradually from the building in every direction, to prevent the water from the melting snow and ice in the spring from settling into the ground, and making the enclosure damp and unwholesome. If the soil is not naturally sufficiently dry, let it be thoroughly underdrained.

Such barns are usually built with a wall on the back side and one-half of the ends, like the cellar wall of a house, but the sills of the building should be placed high enough above the general surface of the ground to admit a window two feet wide. A barn 60 by 40 feet should have at least ten such windows. They should be hung upon hinges, so that they can be opened and shut at pleasure. By this arrangement good and sufficient ventilation can at all times be secured.

The space in the basement of such a barn can be divided into several separate enclosures to meet the wants of the flock, and each enclosure should open on the front side into a yard at least twice as spacious as the apartment under the barn. Around these yards should run a substantial board fence five feet high, and if in a dog region, it should be surmounted with a row of pickets. This simple provision will render it dog-proof.

Much will be gained by keeping only a small number of sheep in the same enclosure. If fifty sheep are to be wintered in a given space, let the space be divided into two pens, and twenty-five put in each. With the same keeping they will go through the winter much better than if allowed to run together. In pleasant weather sheep should be allowed to run in and out at will, and thus secure the exercise necessary to the fullest degree of healthfulness.

When shut in the fold at night the windows should be so adjusted as to allow the admission of a plentiful supply of fresh air. This latter point becomes the more necessary as the spring approaches, when the still cold season of midwinter has passed and the air becomes heavy with damp exhalations. Not long since I visited a sheepfold, where the animals, a flock of fine ewes, seemed to be in a state of semi-torpidity, so closely was all the pure air of heaven shut out, and all the foul emanations of fermenting manure kept in. The best sheep in the world could not flourish in such a condition.

Pure air is as indispensable to the health of an animal as to the health of a man, and it will suffer proportionably when deprived of it.

WATER.

Many men once thought that sheep could live very well without water, but it was when the same men thought that because they had a covering of wool they could winter very comfortably on the northwest side of a hay-stack.

It is true sheep will go through the winter without water, but they will do very much better with it, and not only so, but it should be running water.

Sheep will drink more frequently and with far keener relish at a trough where the water is constantly running in and out, than at one into which the water is pumped.

The drainage pipe which carries off the waste water should be so adjusted as to allow the trough to fill within an inch of the top. The trough should then be covered with a closely fitting cover, and through this, and quite near the edge to which the sheep come to drink, two or three oval-shaped holes should be cut, about two and a half inches in the short diameter and five in the long.

If the sheep are to come up to the side of the trough, have the holes cut crosswise in the cover; if they are to come to the end, cut them lengthwise. A sheep will quickly learn to put its nose through these holes for the water, and then the wool about the face and heavy folds of the neck will be kept out of the water, and thereby the animal saved from a vast amount of discomfort arising from the wool about the neck becoming wet and frozen.

The more one studies the habits of the sheep, the more will the fact of the extreme fastidiousness of the animal be impressed upon his mind, and the careful flock-master will soon learn that when he regulates his care in accordance with this peculiarity he will be well compensated for all his painstaking.

Not only will sheep drink with better relish of running than of standing water, but a little observation will convince any one that they will visit very often a trough arranged as already described, where they are obliged to touch only their lips to the water, when they would hold back till driven by sharp thirst from a trough where they could only drink at the discomfort of having the wool about the neck wet and frozen for hours.

THEIR FOOD.

Many experiments have been instituted to determine the relative value of various kinds of food for stock. But while not one man in a thousand is so situated as to be able to carry out in detail the lessons these experiments are calculated to teach, there is one fact which all can understand and reduce to practice, namely, *that sheep require a variety of food*. There can be no question but what if a part of all the grasses and herbs which they crop in the summer could be provided for winter, the healthfulness of our flocks would be much increased; but as this is out of the question, every careful keeper of sheep will aim as much as possible to meet this demand of nature.

Of the various kinds of grasses for summer and winter feeding, clover stands at the head; hence every man should stock his fields as frequently as possible that he may have a plentiful supply for his barns.

Much may be gained in winter by changing from one variety of feed to another. A feed of well-cured corn fodder or straw will be relished three or four times a week. If a given amount of fine and coarse hay must be fed, let a change from one to the other be made every three days. From the first of December to the first of March sheep should have as much hay as they will eat, with none to waste, twice a day. During March and April they should be fed three times a day.

In every apartment there should be a salt box kept constantly supplied with salt with which about two ounces of sulphur to the quart has been mixed. This simple provision will go far towards preventing all the intestinal diseases that are likely to attack sheep while being confined to dry feed.

Stretches are very seldom known when sheep have access to a plentiful supply of salt, and I believe if they were provided with sulphur in addition to the salt the disease would never make its appearance.

FEEDING TURNIPS.

The fact which should decide what use should be made of turnips in winter feeding is not how many pounds of turnips are equal to 100 pounds of hay, and what is the relative cost of their production, but it is this: *stock does better with than without them; therefore feed them.* Turnips furnish much that the animal gains by direct contact with the soil in summer, and which meets a necessity of the animal organization that dry food alone fails to supply. How much good a given amount of turnips will do an animal is not to be determined by the amount of nutriment the chemist may find in them, but by the noticeable fact that a flock will thrive better on a less amount of hay and grain where a daily ration of turnips is fed.

The amount to be fed each man will regulate according to circumstances. A bushel per day to seventy-five sheep is a fair allowance, and may be increased to advantage, especially with breeding ewes, as they approach their yeaning time. Having been cut, they should be put into a trough and the daily allowance of meal for the flock sprinkled upon them, and both will be eaten with greater relish than if fed alone.

FEEDING GRAIN.

There is no uniformity in regard to the practice of feeding grain by good flock masters. One man feeds only a fair amount—a half bushel of mixed grains, as corn, oats, and bran, in equal parts—and carries his sheep through the winter in good condition; another keeps his sheep fit for the shambles the year round. The more judicious method is to feed enough to keep the sheep in good thriving condition. Other things being equal, sheep that are only kept in good vigor will give better stock than if kept over-fat.

The same rule in regard to variety should be observed here as in feeding hay. Bran or shorts, if fed liberally to breeding ewes as yeaning time approaches, will promote a full flow of milk. Breeding ewes should also be fed more freely during and for a few weeks succeeding the coupling season, in order to give the fœtus a good start.

REGULARITY OF FEEDING.

When all the foregoing conditions have been complied with—warm shelters and dry yards, pure running water, the sweetest of hay, and the richest of grain—it is a notable fact that some flocks of sheep never look well. Some are poor and feeble, and go drooping in an abject condition around the fold. Their wool starts off and hangs in ragged tag-locks along their sides and flanks. They never come to the newly filled crib with a keen appetite, but drag themselves round with evident reluctance, and take their food as though eating was a task. Much of the cause for such a state of a flock will be found in irregular feeding—irregular in point of time and quantity of feed.

Feeding should always be attended to as nearly as possible at the same hour of the day, and the same amount given at each time, except at such times as it is desirable to increase or diminish the usual amount, and then such changes should always be made gradually. During mid-winter sheep should be fed as early as eight in the morning, and never later than four in the afternoon.

As the time approaches for turning the flock to pasture, if grain has been regularly fed during the winter, the amount should be gradually lessened, that the change may not be too great when they are sent to the hills to subsist themselves.

It is not the design of this article to notice many of the minor matters which must receive attention in every well-regulated flock, such as "tagging" and the care of lambs. These points are made sufficiently plain in works upon sheep husbandry. There is, however, one point which seems to demand a moment's attention in this connexion, namely:

DOCKING LAMBS.

This operation should be performed when the lambs are about ten days old. Let an attendant take the lamb, holding its feet firmly in his hands, and press its hind-quarters snugly up to a smooth block, on the top of which the tail of the lamb should be drawn out straight. The operator should be provided with a broad chisel, made quite dull, and only sharp enough to sever the bone without crushing it. The edge of the chisel should be placed firmly upon the tail, about one inch and a half from the body, and the loose skin crowded up towards the body till the point for amputation is reached. Then, with the chisel held inclining outward at an angle of forty-five degrees from the body of the lamb, a single blow with the mallet completes the operation. The bleeding arteries should be immediately seared by a hot iron, which can easily be made ready by a small portable furnace. By this method the usual loss of blood will be prevented, and the consequent check to the growth of the lamb obviated. If lambs are docked when a month or six weeks old, or indeed at any age, and allowed to bleed till the flow stops of its own accord, it will not unfrequently require two weeks for the lamb to make up for this vital drain upon his young and tender organization. Cases of bleeding to death, or so that death occurs as a consequent in a few days, are by no means uncommon.

By this method of amputation two other advantages will be gained—the skin will always readily cover the end of the bone, and the tail will be left in a desirable shape.

THEIR MANAGEMENT IN SUMMER.

For two weeks previous to sending the flock to pasture their allowance of grain should be gradually lessened. When pastures are near the barns the sheep may be allowed to run out for a few hours a day for several days before the final "turning out;" but if they are to be driven any distance, and where they will receive no shelter, they should not be taken from the fold till there is grass enough in the pastures for full and generous feeding. The practice which is often noticeable of allowing sheep to run out about the yards and barns as soon as the ground is bare, or the first shoots of green grass are seen, does not result in any advantage to the flock.

The practice of shearing without washing, and before sending away to pasture, is now quite common with the best breeders in Vermont. The entire flock should be dipped in a decoction of tobacco immediately after shearing, as a preventive against ticks.

When once the flock is "turned off" it should not be forgotten that the salt-trough is as indispensable for the pasture in summer as it is for the fold in winter. A quantity of tar, sufficient to cover the bottom of the trough, should first be put in, and the salt sprinkled upon this. In lapping the salt the sheep will get more or less of the tar on the nose, and this is not only healthful for the sheep, but is an excellent preventive against that inveterate enemy of theirs, the *fly*. A few fresh furrows, turned over as often as once in two weeks, from

the middle of July to the middle of September, will aid the sheep essentially in defending themselves against this vile tormentor. When attacked they will instantly take refuge in the furrows, and, by placing their noses close down to the fresh soil, prevent the fly finding access to their nostrils. This simple means is thought by some to be an infallible remedy against that scourge of the sheep-fold, "grub in the head."

What has been said in relation to the necessity for changing food in winter is equally applicable to summer management.

If the pasture to which fifty sheep are allotted for their summer's fare can be divided into two lots, and the flock put into each every alternate week, they will flourish much better than if allowed free range of the whole. Fifty sheep, if unrestrained, will travel over a hundred-acre lot every day, and each day be obliged to feed just where they did the day before, finding but little fresh grass; whereas, if they should be confined to one-half the field which is to support them for a given number of days, and then changed to the other half, they would find a constant succession of fresh and tender feed.

Particular watchfulness is needed if the flock contains any ewes which are expected to bring up "adopted lambs." Such ewes are quite likely to desert the lambs thus forced upon their care and leave them to "shift for themselves."

As the season for the cold and rain storms of autumn approaches, provision should be made for sheltering the flock from the inclement weather. A drenching rain of two or three days' continuance not only detracts from the appearance of sheep, but is a positive injury to them, and is one of the discomforts which should not be visited upon them when it is possible to avoid it. At the time of coupling the greatest care should be exercised in separating the ewes designed for breeding into lots, according to certain characteristics or qualities, so that those designed for a particular ram can be easily managed. Those having qualities which it is desirable to remedy in their offspring should be put to rams which possess the opposite qualities in a marked degree, and thus a uniformity of size, form, and quality of fleece may be secured.

No man who expects to make any improvement in his flock will allow a ram to "run with the ewes." Six or eight ewes in a day is as many as one ram ought to be allowed to serve when he has the very best of care; with a less number his chances for giving good stock would be much increased.

Many men mistake in leaving their sheep out too late in the autumn, as well as turning them out too early in the spring. They imagine, when the snow holds off till the first of December, that if they can keep their flock in the fields during the greater part of November, they have saved just so much of their winter's forage. This is a mistaken notion, and such men too often find that it will take all the month of December to make up what was lost by compelling their sheep to live for two or three weeks on the dead, frost-bitten grasses of the late autumn.

Thus the circle of the year has been completed by giving some hints in regard to the general management of merino sheep. The multitude of details which it would be interesting to notice, and important for new beginners in sheep-keeping to learn, are not admissible within the limits of such an article; neither is it necessary they should be, since they can be so readily learned from journals in part or wholly devoted to the interests of this great and increasing branch of American industry, and from the very interesting and thorough articles which have appeared in the last two reports from the Department of Agriculture.

WOOL-GROWING IN AUSTRALIA.

BY DR. CHARLES J. KENWORTHY.

At the first settlement of New South Wales (the southeastern portion of the Australian continent) a few sheep were introduced from the Cape of Good Hope. The first effort proved successful, and in 1805 Mr. McArthur imported a limited number of rams and ewes from the Royal Windsor flock of George III; the origin of that flock being a number of choice sheep presented to that monarch by the King of Spain. From the limited importation of Mr. McArthur have arisen the choice flocks of Australia, which have rendered it, "par excellence," the wool-producing country of the world.

CROWN LEASES.

In consequence of the limited amount of cultivable land in Australia, the attention of the earlier settlers was directed to the raising of cattle and sheep. To encourage this new enterprise the government adopted a wise policy—that of leasing, for pastoral purposes, extensive areas of unsettled lands. In the commencement a small rental per annum was charged per square mile; and as sheep and cattle became more numerous, and a greater demand for land arose, the rental was gradually increased. At the present time stations (or as more generally termed "runs" in Australia) vary in extent from 20 to 2,000 square miles. In some instances the rich wool princes purchase the leases of the smaller holders, and thereby secure large pastoral areas. In illustration I shall quote a paragraph from a late issue of the Pastoral Times, respecting two runs in the colony of New South Wales:

"Mr. G. S. Laing has just bought 1,400 square miles of back country, all in one block, situated near to the Upper Lachlan river, and Mr. G. Desailly has 800 square miles on the river Darling."

In the colony of Victoria, stations (sheep or cattle runs) are held under a lease from the government for a given number of years, (subject to renewal by the crown,) at an annual rental based upon the number of animals each run is supposed to support or "carry." The carrying capabilities of each run are determined by commissioners appointed by the government. The estimate, I am satisfied, is, under all circumstances, much below the actual depasturing capabilities of each individual run. The rental is arrived at by an estimate placed upon the number of sheep each square mile is supposed to support, and the number of square miles in the particular run, and a yearly tax of about 15 cents per sheep is laid. To give an idea of the extent and importance of the pastoral interest in the colony of Victoria, I shall freely quote from a return recently laid before the legislative assembly of Victoria, showing the number of runs in each commissioner's district, the number of acres rented from the crown by pastoral tenants, the rent paid per acre, and the amount of income received by the government from this source alone.

Before quoting these statistics I must inform you that a large amount of the best land in the colony has been alienated from the crown; some of the wool princes owning from 30,000 to 80,000 acres in individual blocks. Australia is divided into several colonies, or what you would term separate States; the colony of Victoria having an area of about 57,000,000 acres. Of this vast

area but a small portion is fit for cultivation. My remarks will be entirely confined to the colony of Victoria, but applicable to all the Australian colonies.

Returns showing the number of runs in each of the crown lands commissioner's district, the number of acres rented from the crown by pastoral tenants, and the rent per acre, were laid before the legislative assembly.

Name of district.	Number of runs.	Area in acres at passing of land act, 1862.	Rent per annum.
Arrarat	29	703,024	$55,275
Ballarat	30	207,325	12,290
Beechworth	79	1,488,250	32,360
Benella	104	3,352,301	119,035
Castlemaine	66	1,644,207	58,245
Echuca	49	2,291,785	75,925
Gepp's land, North	37	914,975	22,015
Gepp's land, South	50	1,123,034	16,955
Gisborne	55	824,526	38,315
Grant	41	261,854	21,210
Melbourne	38	809,328	10,875
Omeo	26	819,060	15,890
Portland	89	1,382,358	71,385
Settled district	61	447,660	10,660
Swan hill	97	6,606,595	47,115
Warnambool	98	1,247,322	110,590
Wimmera, East	59	2,308,468	104,925
Wimmera, West	148	5,936,396	301,460
	1,156	31,875,468	1,115,525

Abstract of return showing the area and rent of the several runs in Victoria, as determined under the provisions of the land act, 1862, *classed according to the rate paid per acre.*

Rate per acre.		Number of runs.	Area in acres in 1862.	Rent per annum.
	Under ½ cent	89	6,277,340	$13,010
Over ½ cent	Under 1 cent	77	2,370,680	18,595
Over 1 cent	Under 2 cents	118	3,604,365	58,515.
Over 2 cents	Under 4 cents	337	9,203,617	273,120
Over 4 cents	Under 6 cents	198	4,911,307	240,315
Over 6 cents	Under 8 cents	80	2,334,228	162,715
Over 8 cents	Under 10 cents	87	1,283,836	114,400
Over 10 cents	Under 12 cents	48	918,512	103,180
Over 12 cents	Under 16 cents	68	665,652	89,450
Over 16 cents		54	295.868	52,180
		1,156	31,875,468	1,115,525

The preceding data establish the fact that over one-half of the land in Victoria is held under pastoral licenses, thereby utilizing vast areas of barren and uncultivable land. These data are reliable, and establish the fact that the runs in Australia average over 30 square miles.

Independent of vast areas of purchased land, many of the squatters own a number of leasehold runs, both in Victoria and the adjoining colonies. The runs of Victoria are much the smallest. As an illustration of the extent to

which sheep-raising is carried on in some of the colonies, I shall briefly describe the Bogan river property, which was advertised for sale when I left Australia:

"200,573 sheep, with a large number of lambs given in.
7,000 cattle, with calves under 6 months given in.
150 useful station horses.

"LAND.

"The stations are situated on the Darling, Warrego, and Hittaburra rivers. Fifty of the licensed runs are in New South Wales, and eight in Queensland—all contiguous, and comprising in the aggregate upwards of 2,000,000 acres. In addition to these, 2,000,000 acres have been tendered for, and all requirements of the act complied with, necessary to insure the acceptance of the tenders.'

"The water frontages of the present licensed runs (measured in straight lines) may be estimated as follows:

	Miles.
To the river Darling	98
To the Talawalkus, say two frontages of 50 miles each	100
To the west side of river Warrego	60
To the east side of river Warrego	80
To the west side of river Hittaburra	55
To the east side of river Hittaburra	50
"Total	443

"The grazing capability of the licensed runs is estimated at 400,000 sheep."

The price at which this property was placed in the market was $900,000.

The introduction of pastoral leases into Australia has converted the almost barren wastes of the Papuan into homes for civilized men, and the feeding-grounds of numberless flocks. Independent of the yearly amount received by the treasury annually for pastoral rents, thousands are furnished with employment, various trades and commerce are taxed to supply the wants of those engaged in the calling; and last, though not least, barren Australia is made to contribute to the wealth, comfort, happiness, and prosperity of many lands.

From what I have seen in Australia I am convinced that the waste lands of the south could be utilized if the government could be induced to adopt a liberal policy, and lease the same for pasture purposes. To engage successfully in sheep-husbandry on poor land, such as the most inferior to be found in the south, requires that those engaging therein should have complete control over areas of sufficient extent. Such advantages could only be secured by a lease, or the opportunity of purchasing at a reasonable price a sufficient quantity of land.

THE HOME STATION.

As before remarked, squatters have purchased large areas of land from the government for pastoral purposes. This land was sold at public auction, and varied in price from $5 to $50 per acre. When purchased, the owners generally enclose their land with a sheep-proof fence. If the fence is constructed of brush the cost is about $200; if of posts, one top rail and from four to six wires, about $500 per mile. The enclosure is afterwards divided into paddocks, varying from 1,000 to 5,000 acres. By fencing in the land, shepherds and hut-keepers are, to a great extent, dispensed with, the cost of the production of wool reduced, as well as the quantity increased, and the staple improved.

Upon runs leased from the government, each squatter has his home station, located upon a pre-emption section of 640 acres of purchased land—the government awarding the squatter the privilege of purchasing that area at the minimum price of $5 per acre. Upon the pre-emption section is located the squatter's residence, wool-shed, overseer's house, and the necessary buildings for employés and for carrying on the business. In the thinly settled districts many of the buildings are of a very primitive description, being built of "wattle and daub," or split slabs, averaging two inches in thickness, and eight inches in width. The wool-shed is usually a large building, averaging 40 by 100 feet. The frame, in a majority of cases, is constructed of poles and saplings, the roof and sides being covered with the bark of the "stringy bark tree"—the *eucalyptus gigantea.* Near cities, where labor and building materials are cheap, the erections, in some cases, are of better materials and construction.

WATTLE AND DAUB BUILDINGS.

I have referred to buildings constructed of wattle and daub, and as a description of their mode of construction might prove serviceable to settlers in districts where stone and timber are deficient, (as on the prairies of the southwest,) I shall briefly describe their construction. In the first place a skeleton frame is constructed of saplings and poles. The sills and plates are from four to six inches in diameter, and auger-holes are bored through them at distances of about one foot. In the auger-holes are fitted poles varying from two to three inches in diameter, and of the height of the walls. Slender brushwood is obtained and woven in and out between the studs; after which the inside and outside are plastered with mud. If lime is obtainable, the walls receive several coats of whitewash. The roof is usually composed of split palings about five feet long, and eight inches wide, or of the bark of the "stringy bark tree." In most cases the roof projects two or three feet beyond the walls, protecting them from the weather. A building of this character is durable and comfortable, and where the materials are easily obtainable it can be erected cheaply and expeditiously.

HUT-KEEPERS AND SHEPHERDS.

Situated at different points upon the station, say six to ten miles apart, are huts for the accommodation of hut-keepers and shepherds. These buildings are of rude construction, and, as a general thing, are about twelve by sixteen feet; with one fireplace, one door, and occasionally one window. These buildings furnish accommodation for one hut-keeper and one or two shepherds. Each shepherd has charge of from 1,000 to 2,000 sheep; and to assist him in taking care of his flock, he is provided with several colley dogs. At night the sheep are driven into a sheep-proof enclosure constructed of hurdles, where they are kept until morning. Very early in the morning they are driven out to pasture. Night and morning they are counted by the hut-keeper and shepherd, which precaution compels the latter to exercise due care over his charge. As soon as removed from the enclosure, the shepherd starts with his flock, and allows them to travel and feed in a given direction until about mid-day, when they are turned homeward. By this arrangement the sheep travel from four to eight miles daily. By taking a different direction each day, a change of pasture is secured. Thus in the poorer portions of the colony from 20 to 40 square miles are appropriated to the pasturage of a single flock. Owing to the large number of sheep owned by one squatter, the character and habits of the shepherds and hut-keepers, the sheep do not receive the care and attention they so justly deserve. I am prepared to admit that on some stations the greatest care is taken of the flocks, but these stations form the exception. It is sad to witness the extent to which foot-rot and scab prevail on some of the runs. On some stations the hur-

dles occupy the same site for years; and I can assure you that I have seen the ground covered to the depth of ten inches with the excrement of these animals. Upon such a bed they are huddled together night by night and year by year. Sheep are so plentiful in Australia, and the merinos are so hardy that they are subjected to treatment which would astonish an American wool-grower. Nevertheless they increase and prove remunerative.

In outlying districts, where sheep are liable to suffer from native dogs, (the Australian wolf,) they are guarded during the night by the hut-keeper or shepherd, who sleeps in a movable watch-box placed near the enclosure.

PASTURAGE.

The quality of the land or the poorness of the pasture does not prevent the successful production of wool; for wherever there is anything to eat, sheep live, increase, and produce the useful staple. Localities without water, and little or no herbage during the summer, are utilized during the winter months. The only obstacle in the way of using every acre in Australia for pastoral purposes is the existence of large patches of dense and impenetrable scrub, and localities densely covered with creepers and tangled undergrowth. Where the timber and undergrowth is so thick that sheep cannot obtain sufficient pasturage, horses and cattle are raised. In some portions of Australia, as between Melbourne and Portland, vast treeless plains or prairies exist, some of them but a few feet above the surface of the ocean. These localities were stocked with sheep during the earlier days of the colony; but as the elevated interior became settled they were to a great extent deserted.

This change was brought about by the commonly entertained opinion that sheep require an elevated and hilly country.

Sad experience taught the owners of runs on the low-lying plains that they had committed an error, and they gladly returned with their flocks. At present these low, open, and treeless plains are densely stocked with fine-bred and healthy sheep. As an instance of the quality of the wool produced I need but refer to the position attained by the wool of J. L. Currie, esq., at the two great exhibitions held in London, and the great demand which exists in Australia for his rams for stock purposes. In forming an opinion of Australian wool, due allowance should be made for the fact that it is raised upon natural pastures; that the sheep receive no artificial food; and that the animals are never sheltered.

With regard to the pasture in Australia, I can only say that in a few favored localities surrounding extinct volcanoes it is good, the natural grasses being fine and succulent. As an instance of one station favored in this respect I may cite Ercildoun, the residence of the Messrs. Learmonth. As a general rule, the feed during the winter and a portion of the spring months is plentiful; but as soon as summer sets in with its hot winds the grass dries up in a few days, and the sheep are compelled to subsist for weeks and months on the remains of the parched-up annual and perennial grasses. The three main grasses of Victoria furnishing sheep with feed are annuals. I have secured seed of them and shall send samples to the Department of Agriculture at Washington for experiment. If they could be introduced into the southern States I am convinced they would prove beneficial.

I have not visited the extensive sheep region of the river Murray, but have obtained many facts from intelligent gentlemen engaged in sheep-raising in that district. During the winter season the Murray river overflows the adjoining flats; and, after the river falls, a gross and luxuriant vegetation springs up on the bottoms. Within a few days after the hot winds set in, this ephemeral vegetation withers, and is trampled to dust by the sheep. I have been assured by several extensive and reliable squatters that when food becomes scarce the sheep will visit these flats and lick up the fine vegetable matter

FACTS FROM WOOL-GROWERS.

The following letters afford valuable information upon important practical points. The Messrs. Learmonth are the most eminent breeders in Victoria. That of Mr. Thomas Learmonth refers merely to the sheep upon his home station.

ERCILDOUN, NEAR BALLARAT, *September* 7, 1864.

DEAR SIR: I have to acknowledge receipt of yours of the 22d ultimo, which I have delayed answering till I was able to procure information regarding the queries you put to me about sheep-raising in this district.

Taking your queries as you note them down, I will give you my answers as shortly as I can:

1st. Number of sheep kept in a flock?

Answer. In this district, sheep are now rarely shepherded; that is, followed by a shepherd and dog during the day, and folded at night. Since the wild dogs have been exterminated and most of the country passed from the crown into private hands, sheep-runs have been fenced in, and the sheep run at large day and night in paddocks—fields. In the poorer parts paddocks of 10,000 to 12,000 acres in extent are met with, and in these 7,000 sheep run at large. In this neighborhood, the pasture being finer, paddocks are seldom larger than 3,000 acres; and for myself I prefer that they should not be more than 1,000 acres, which will feed 1,500 to 2,000 sheep. One shepherd, mounted on horseback, can take care of two or three such paddocks. On the old system of shepherding, one man could take care of 1,500 sheep or more, according as the country was wooded or open. Two flocks, feeding in opposite directions, were sometimes kept at one out-station.

2d. The distance that sheep travel during the day, when in their usual feeding ground?

Answer. A flock can easily feed two miles before noon and the same distance back again in the afternoon.

3d. Kind and number of dogs kept with each flock?

Answer. The ordinary English or Scotch sheep dog. I never allow but one.

4th. Wages to shepherds?

Answer. From $150 to $200 per annum.

5th. Wages paid to hut-keepers?

Answer. From $125 to $150, with rations in each case

6th. Cost of rations?

Answer. About $75 per year per man.

7th. Time and mode of shearing?

Answer. In this district sheep shearing commences in the beginning of October and lasts for six weeks or two months; shearers get $3 50 per 100, with rations, and average about 50 sheep per man per day, though some good hands can shear 100 per day, The sheep are not laid on a stool with their legs tied, as is in some places the custom, but are merely held between the workman's legs during the operation—which, to state the truth, is generally roughly performed in Australia.

8th. Price of wool?

Answer. The average price for last year's clip was probably two shillings (50 cents) per pound; some of the Ercildoun wool brought three shillings and fourpence, about 82 cents, per pound.

9th. The average product of wool, washed and unwashed?

Answer. This, of course, varies much. Probably the average may be, in this district, 2½ pounds for the former, and 4 pounds for the latter. The sheep on this property averaged as follows last season:

12,155 old sheep clipped, 39,394 pounds, averaged 3 pounds 3¾ ounces per sheep.

6,924 six months old lambs, 12,306 pounds, averaged 1 pound 12½ ounces per sheep.

163 inferior rams, 1,146 pounds, in grease, 7 pounds.

The wool brought in London £6,537 14*s.* 6*d.*, (about $32,000,) or six shillings and nine pence half-penny (about $1 62) per sheep. Thus it is seen that the whole clip averaged about sixty cents per pound. During the year Mr. Learmonth sold 900 rams for breeding purposes, which brought him in about $30,000. The yield, per head, seems small, but it must be remembered that the yearly sale of all the rams he can spare, and the fact that his sheep are all thoroughly washed in warm water and then spouted, tend to reduce the clip per head.

10th. Time of coupling ewes and rams?

Answer. In this district generally during the months of October and November, as the early autumn lambs dropped in March and April are always the best.

11th. How done?

Answer. One ram is allowed to sixty or seventy ewes, and that number being put into the ewe flocks, no further trouble is taken.

12th. Treatment of ewes during gestation?

Answer. No particular treatment. They are disturbed as little as possible.

13th. When are lambs weaned?

Answer. In September or October, when they are about six months old.

14th. How treated then and subsequently?

Answer. At the time of weaning there is plenty of spring grass; so that nothing more is done than to turn them into a good paddock.

15th. The origin of your flocks?

Answer. They were imported into Tasmania in the year 1830, from the Elector of Saxony's flock. (Since their importation they have been crossed with the descendants of the royal Windsor flock; at least so I have been credibly informed.)

16th. The effect of the climate of the interior upon the wool?

Answer. The wool gets shorter and lighter in the country north of the Murray river; the weight being, perhaps, 25 per cent. less than it is in this district, but it retains its fineness.

17th. The highest average attained by the thermometer in the north?

Answer. I have no means at hand to enable me to answer this query. It *often* stands at 110 to 113 in the shade in the summer.

18th. The average price obtained for your wool?

Answer. About 62 cents per pound, including pieces and locks.

19th. The number of sheep in your flocks?

Answer. On this property we shear this season about 31,000 sheep.

20th. The number of rams sold during 1863?

Answer. We sold about 700.

21st. Average price of rams in 1863?

Answer. Over $35 00 per head.

In answering these queries, if I have not been sufficiently explicit I shall be glad to afford you any information you may wish for.

I am, dear sir, yours faithfully,

THOMAS LEARMONTH.

Dr. C. J. KENWORTHY, *Ballarat, Victoria.*

In a note appended to Mr. Learmonth's letter I have referred to his mode of washing. In compliance with his request, I inspected the whole process, and will hereafter attempt to describe it. As far as my reading or observation has extended, it is the perfection of sheep-washing. The next letter I shall copy

is one from J. Clough, esq., one of the largest wool brokers and auctioneers in the Australias. He annually sells at auction thousands of imported sheep; this being the fact, and as he mainly draws his views from those who purchase at his sales, he, as a matter of course, is in favor of imported sheep, and advocates their use and introduction.

CLOUGH'S WOOL WAREHOUSES,
Melbourne, August 22, 1864.

DEAR SIR: I regret that I have allowed your letter of the 6th instant to remain so long unanswered, and beg that you will not attribute the delay to an indisposition to comply with your request, which I assure you affords me great pleasure. I will at once proceed, to the best of my ability, to answer your several questions in the order in which they are put to me.

1st. Name and address of some of the larger flock-masters?

Answer. This information you will find in the accompanying list, marked A.

2d. The breed of sheep raised by them?

Answer. They are principally merino, although in some instances they are crossed with the Leicesters, Cotswolds, and Southdowns, according to the respective fancies of the breeders.

3d. Average number of sheep kept in one flock?

Answer. From 2,000 to 3,000 head.

4th. Average yield of wool?

Answer. About 5 pounds per sheep, greasy, and 2½ pounds washed.

5th. Average price of wool?

Answer. The average price for Australian wool, in this market, I should quote at from one shilling and sixpence (about 30 cents) to two shillings and twopence (about 50 cents) for washed wool; of course, there are exceptional prices outside of these quotations, both higher and lower.

6th. What blood preferred in rams?

Answer. Amongst the choice flocks of the colony, the Steiger blood has been most highly appreciated; but both the Negretti and Rambouillet blood have been more recently introduced. It is almost too soon, however, to determine from their results whether they are likely to turn out as well as the Steiger blood. The same observation applies to the recently imported American sheep of Mr. Campbell; although the prices which they realize show that they were highly thought of by our wool-growers, from their general appearance and character.

7th. Shepherds' wages, rations, &c.?

Answer. Shepherds' wages range in this country from £40 ($200) to £50 (250,) and that of hut-keepers perhaps a trifle lower.

8th. Rations for the same?

Answer. The cost of rations for shepherds and hut-keepers is generally reckoned to come to about as much as 10 shillings ($2 50) per head per week.

You are probably aware that we held an auction sale of pure bred imported rams and ewes last week, which extended over three days, and a large number of sheep passed the hammer, at such prices, however, as must be very discouraging to importers; many of the fine sheep having changed hands at such a figure as scarcely covers freight and charges.

I shall only be too happy to communicate any information in my possession, or in any way assist you in obtaining information. In conclusion, I have the honor to remain,

Yours, very respectfully,

J. CLOUGH.

CHARLES J. KENWORTHY, M. D.,
Sebastopol, near Ballarat.

I addressed a letter to Mr. Sargent, a squatter at Mount Eyre, Sturtland north of Adelaide, the most barren, waterless, and arid portion of South Australia, and I shall briefly quote his replies to my queries:

1st. Number of square miles in run?

Answer. 120.

2d. Character of the country?

Answer. Very rugged and stony.

3d. Character of the grass, if any?

Answer. None of any consequence, except about the banks of creeks, and that long, rough and wiry.

4th. Upon what description of herbage do the sheep subsist?

Answer. Upon salt bush.

5th. The amount and description of water?

Answer. Very scarce and very brackish.

6th. The number of sheep kept by you?

Answer. About 8,000.

7th. About the yield of wool per head?

Answer. About four pounds.

8th. Do sheep thrive and keep fat upon salt bush?

Answer. Yes, and keep very fat.

9th. The description of wool produced?

Answer. Very good, but not quite equal to the fleeces on rich soil.

10th. About the length of the dry season?

Answer. Nine months.

11. Does rain ever fall during the dry season?

Answer. No.

12th. Range of thermometer during summer?

Answer. Have kept no record, but enclose report of colonial astronomer of range of thermometer at Adelaide during the hot months: "The hottest months in the year are December, January, February, and March, when the temperature of the air about Adelaide exceeds 100 degrees for several days together, at times rising as high as 115 degrees."

WAGES OF ATTENDANTS.

In the management of sheep in Australia, as a general rule, everything is done in the most primitive manner. In a majority of instances those who hire themselves as shepherds and hut-keepers are the most intemperate and worthless portion of the population. They are a class by themselves, and must be seen to be appreciated. I cannot compare them to any class in the United States. I have referred to hut-keepers, and as the character and duties of this particular class are not familiar to our people, I shall attempt an explanation. He who hires himself for this position is, in almost every instance, a remarkably lazy man. His duties are to receive and cook the rations for himself and the shepherd; to prevent the hut from running away during the daytime; and to count out the sheep in the morning. For discharging these onerous and laborious duties he receives nearly as large wages as an industrious farm hand in the United States.

Mr. Learmonth's estimate of wages and rations is, as a general rule, too low, and evidently based upon what is customary in the thickly settled districts. Taking the colony as a whole, I believe that Mr. Clough's statements are nearer the truth. From my own observations, I should say that the following is a fair estimate of keeping a flock of 2,000 sheep for one year:

Government tax	£30		$150 00
One shepherd	40		200 00
One hut-keeper	30		150 00
Rations	40		200 00
Shearing, at $3 50 per 100			70 00
			770 00

In the north it would cost much less to keep a flock one year, for wages and provisions are cheaper. In Australia the hut-keepers seldom, if ever, attempt to raise vegetables, animals, or fowls. In the south or west, if a hut-keeper was employed, he could raise pork, corn, potatoes, and vegetables sufficient to supply himself and shepherd. With assistance at planting time and at the period of gathering crops, the hut-keeper would be enabled to supply his employer with a surplus for market.

From information obtained, I am satisfied that the services of a first-class Scotch shepherd and his wife could be obtained for from $250 to $300 per annum, if allowed pasturage for a cow and the privilege of cultivating a small garden. From what I have seen of the Chinese in Australia, I am convinced they would make valuable shepherds and hut-keepers, if they could be introduced from Singapore or Hong-Kong. Their wages would not amount to more than $80 per annum. Their rations would cost but little, for a Chinaman wants but little meat, and can live upon rice.

DISEASES.

The main diseases of the colony are foot-rot and scab, both of which prevail to an alarming extent. In travelling through Australia it is really distressing to see the number of crippled sheep feeding in the greatest agony. Owing to the moist condition of the soil during the winter months, the number of sheep kept in one flock, and the little attention paid to them, the disease must of necessity be prevalent. The remedies for foot-rot are similar to those of the United States, and I need not refer to them.

So prevalent is scab in Victoria that the government has appointed commissioners whose duty it is to inspect flocks; and the legislators of the adjoining colony of Queensland have such a horror of the scabby sheep of Victoria, that they have passed a stringent act preventing the introduction of Victorian sheep into that colony. Remedial measures, when adopted for the cure of scab, are generally trusted to careless and ignorant shepherds. I shall refer to but one instance of many which have come under my notice. Mr. M. had a flock of 1,000 sheep, which came in contact with a scabby flock belonging to a neighbor; the sheep became affected, and to effect a cure a bath of arsenic was prepared. The thermometer stood over 100° in the shade; the sheep were driven seven miles over a dusty road without water. Upon arrival at the home station they were driven through the narrow tank containing the arsenical solution; being thirsty, and the shepherds neglectful, they drank of the bath; the result was that 700 out of the 1,000 died from arsenical poisoning.

Various remedies, including several patented nostrums, are used for the cure of scab; but I am convinced that sulphur and tobacco will cure the disease, and am happy to state that these remedies are entirely depended upon by many of the most intelligent squatters of the colony. I shall quote freely from an article from the pen of Mr. Thomas Shaw respecting scab. His statement is valuable, for he is unquestionably the best authority in Australia:

"The diseases chiefly affecting sheep in these colonies are catarrh, scab, and foot-rot. The last named is a local disease, peculiar to certain districts having a particularly rich, soft soil; a flock of sheep, however badly affected, will, in

a short time, recover without any dressing if removed to a light sandy or dry stony run.

"The scab is a very contagious disease, and when it once appears, if not speedily and properly dealt with, very rapidly spreads through a whole flock, and even a whole district. Although it affects no vital part, but merely the skin, yet it has been a severe scourge at various times in many parts of these colonies. It has been the cause of great expense, as well as immense loss of stock from death and stoppage from increase. This loss, in most instances, may be attributed not to the disease so much as the improper ingredients used for its cure, viz., mineral poisons of various kinds, far more effectual in killing the animals than in curing the disease. The chief of these poisons is arsenic—a word that has become quite obnoxious to me on account of the awful havoc it has made in flocks in Victoria. The extensive and almost universal use of this obnoxious and destructive poison has in fact been the cause of the most serious loss of stock that has taken place in that colony in connexion with scab. Hundreds of thousands of sheep have been killed through arsenic without the desired cure of the disease being effected. In those that survived it might have been checked, and apparently for a time destroyed, but in time it appeared again as bad as ever. This—a simple disease of the skin, destructive, indeed, to the growth of wool, but comparatively harmless as regards the mortality of the animal—has been made a most serious one by the use of poisonous drugs; and in many instances the supposed remedy has been a thousand times more fatal than the disease. I speak feelingly on the subject, because, like many more, I labored hard for several years with anxious zeal and sanguine hopes of curing the scab with arsenic. I used it in every conceivable way, and sometimes felt confident that I had succeeded, but time proved the contrary; and it was apparent in the number of sheep poisoned, the injury done to the wool, and the constitution of the living; but the disease was still there, being merely checked and lying dormant for a time. I have known sheep dipped in arsenic five times in one season with the greatest care, and still not cured. I do not mean to say that scab was never cured by arsenic; but I say in all my experience through a great part of Victoria, during the hottest rage of the scab, I never knew an effectual cure made of it. I have known many declare that they had done so, and some even wrote in newspapers, to have it published and to direct others in the way to use it in order to succeed, and after all have been deceived. Happily, experience and numerous experiments have led to a *mild, speedy, and most effectual cure of this disease*—one not at all injurious to either sheep or wool. Indeed it nourishes and supports the latter in its growth. This is the simple use of tobacco and sulphur—one pound of each to five gallons of boiling water. The sheep to be dipped in the mixture, as hot as they will bear it without scalding them, three times, with an interval of a fortnight between each dipping. I never knew the remedy fail in perfecting a cure; and with no more loss in sheep than may occur during washing, and in nearly as short a time as it would take to kill and burn them, and with no more expense; and with this immense advantage, that as long as the sulphur remains in the wool it acts as anti-contagious as regards scab. In looking over the works, English and American, in my possession, I find that arsenic and corrosive sublimate are the remedies most highly recommended. I take great pleasure in noting the efficacy of sulphur and tobacco in the cure of scab. It is certain that this disease prevailed to such an extent at one time in Australia that flock owners were necessarily compelled to kill and burn the sheep most extensively diseased."

WASHING.

In many localities in Australia water is too valuable to be used for washing sheep, and, as a consequence, the wool is sent to market in the grease. Where water is obtainable, creek or pond washing is resorted to. A few of the more

intelligent and progressive squatters have travelled from the beaten track, and use warm water in washing their sheep.

Without models, or carefully prepared diagrams, it is difficult to comprehend a complicated process from an imperfectly written description; I shall, however, attempt to make the process intelligible. Mr. Learmonth kindly invited me to visit his beautiful estate, and inspect in detail all processes connected with washing, shearing, and preparing the wool for market, as carried out on this model station. After carefully examining everything, I found that order, neatness, and cleanliness characterized the most minute detail of wool-production.

Thirty years ago the Messrs. Learmonth left Melbourne in search of a run. After days of difficult travel they reached the pleasant spot named Ercildoun. They camped for the night at the base of a high granite mountain, and to the east and north volcanic cones rose before them. They could find no water; the pasture was burned up; and as desolation and aridity surrounded them, they named the locality "Mount Misery," which name it still retains. More carefully examining the neighborhood, they found a winter marsh of about 800 acres, with a tenacious clay bottom, situated between the granitic and volcanic mountains. Resolved upon making this their future home, they set their wits to work to obtain water. To accomplish this they threw up an embankment across the outlet of the marsh referred to, and by open drains conducted the water from the adjoining water-sheds. From that time to this they have had an inexhaustible supply of water for stock and irrigation, as well as for supplying a beautiful artificial sheet of water half a mile in length in front of their residence. Here was a desert during the summer, without one drop of water; and now it is one of the most beautiful places in the colony.

The sheep to be washed the ensuing day are drafted into a square divided into four yards. In these the sheep are packed as closely as possible. By the aid of a hydraulic ram water is forced into a tank placed at an elevation of about twenty-five feet above the pens containing the sheep. A small gutta-percha hose with a rose at the end, and of sufficient length to reach all the pens, is connected with the tank. During the night and ensuing day, until the sheep are washed, a man is employed in "hosing" or playing upon the sheep with the water from the tank. By this arrangement the sheep are kept wet for a number of hours, and all dirt becomes softened and ready for effectual removal by the succeeding processes. When watching this portion of the operation I was forced to the conclusion that it would prove more effectual if the sheep could be placed in a building and warm water used for the "hosing." This end could be readily attained by passing the water into the lower part of a boiler, and out of the boiler at the upper part. This process would merely entail the necessity of providing a suitably constructed boiler, and the wood consumed in fuel. The person engaged in "hosing" the sheep could attend to the firing.

Seven to nine sheep are drafted at one time from the "hosing" yards and thrown into the hot-water tank. The hot-water tank is about seven feet deep, seven feet wide, and ten feet long. The tank is filled to a depth of about three feet six inches with water, at a temperature of about 110° of Fahrenheit. When first filled, about ten pounds of potash are added to the water and dissolved before washing commences. The sheep are made to swim about in the tank until they become faint; attendants stand by the tank and carefully push the bodies of the sheep under the surface of the water. They gently knead the wool on the backs of the sheep with a kneading-stick of the following construction: A piece of light wood, two or three inches thick and two feet long, has a hole bored in the centre; into this hole is fitted a light handle, about eight feet long. If a sheep is weak, and becomes faint before it is sufficiently washed, its head is carefully kept above water by passing the kneading-stick under the chin. An enclosed passage, closed by a suspended gate, leads from the hot

tank; and when the wool is sufficiently soaked, the gate is raised and the sheep are driven to a small enclosure at the edge of the spouting tank.

The "spouting tank" is about 10 by 15 feet, and contains about 3 feet 6 inches of water. Fixed in the pool are four narrow barrels about 4 feet 3 inches high. Between the barrels are fixed spouts about 2 feet 6 inches wide, at an elevation of four feet above the water in the tank. These spouts deliver a body of running water about four inches in depth. An attendant throws a sheep into the tank, and as soon as it rises to the surface of the water it is seized by the washers and placed under one of the spouts. One supports the head to prevent drowning, whilst the other turns the animal over and manipulates the wool. When thoroughly washed, the animal is pushed towards an inclined passage leading from the tank. If necessary, it receives assistance in departing from its hydropathic treatment. Faint and weak the animal staggers or stands for a time, with its water-logged fleece, until able to travel, when it leisurely passes into a clean and heavily grassed pasture.

By this process of washing the fleece becomes thoroughly cleansed. If some of the American flocks received the same attention in washing as is bestowed upon the Ercildoun flocks, we should not hear of such heavy clips as I have seen noticed in some of the American agricultural journals. I believe that the mode of washing which I have so briefly and imperfectly described is the best and most perfect extant. I may remark that the water in the hot tank is changed two or three times during the day.

THE ALLEGED DETERIORATION OF WOOL.

I am aware that the popular opinion prevails, that if "sheep are raised in a warm climate the wool will turn to hair." Some months since I received a communication from a respected and valued friend in New York, in which he stated that he had reason to believe that I intended engaging in sheep-husbandry in the south, and that I was on the wrong track, as he had always been led to believe that wool would turn to hair in a warm climate. This gentleman had been a resident of interior Georgia for many years, and had no doubt formed his opinions upon statements made in that region. I am aware that this opinion is even advocated by some standard authors upon sheep-husbandry, and if it is an error the subject should be thoroughly ventilated. Instead of simply asserting my own opinion with regard to this subject, I shall quote from some of the best authorities of the day.

The following extract is from an essay by the late Dr. Royle, the highest authority which can be quoted on the productive resources of India, and is very satisfactory upon this point. It will be found in Southey's work on colonial wools: "Considering the tropical nature of many of the substances of which we have treated, and that *wool of a good quality* is thought to be the produce only of cold countries, it may startle many but partially acquainted with India to hear of wool as a product of that country. Yet from the oldest records we possess we find the tending of sheep, and the preparation of clothing from their wool, one of the earliest occupations of mankind in the warm and dry regions of the East."

Mr. George Windsor Earle, member of the Royal Asiatic Society, in a lecture on the "Tropical Resources of Australia, delivered before the South Australian Philosophical Society, remarked: "In fact, Spain itself, native country of the fine-wooled sheep, is more tropical in its character than any other country in Europe, the plains of the south bearing a close resemblance to those of India, and *it must be here that the merino flocks* acquire the peculiar fineness of fleece; for the herd of native sheep on the mountains in the north of Spain produce wool of a very coarse description."

In the early days of Australia the English government established a settle-

ment (named Port Essingdon) on the northern side of the island, and it proved a failure. The material of which the settlement was composed was of the wrong description, and everything went to ruin. Writers, including Mr. Earle, based their opinions of tropical Australia upon the results of that undertaking. At a meeting of the South Australian Philosophical Society, held on the 18th of October, 1864, the subject of "Wool-Growing in Northern (tropical) Australia" was thoroughly discussed, and I shall freely quote from a report of the proceedings of the meeting.

"Mr. Wells remarked that he should have to refer to Mr. Earle's paper, because that gentleman's views on the subject of wool-growing in Australia appeared to have undergone a great change. His first work on tropical Australia had been quoted in England to support the idea that North Australia was a country altogether unsuited to the sheep farmer. In that work, which was published eighteen years ago, it was said 'that sheep taken to Port Essingdon from New South Wales did not thrive,' and the writer went on to say, 'Even if it be found that other pasturages are better suited to them, the nature of the climate generally forbids the hope that wool, the staple export from the northern colonies, can ever be produced in the tropical regions.' Now, as this quotation and the remarks of the falling off observable in the sheep which were taken to Port Essingdon had been used and commented upon in England, it was lucky that Mr. Earle, in his recent paper, had explained that what he said in 1846 must now be accepted in a considerably modified form. Mr. Earle's remarks were, 'Upon the whole, I think that sheep wool may safely be included in the future products of the tropical regions.' From this it appears that the writer had materially modified his views as to the wool-growing capabilities of a tropical country."

In continuation, Mr. Wells remarked: "As to the value of the information which was really possessed on the subject, it went far to prove that Northern Australia might soon be a great wool-growing region. According to theory, it ought not to be so, perhaps; and that was the reason why so many objections were raised to the facts brought forward. At a meeting of the Royal Geographical Society of London which took place in August, 1863, Mr. Alfred Wallace stated, during a discussion relative to the capabilities of North Australia, that the district which it was proposed to colonize from South Australia was not only tropical, but almost equatorial in character, the Victoria river being on the 15th degree of south latitude. He did not believe they would find any country in the world within 15 degrees of the equator in which European and wool-bearing sheep could exist; consequently, the colonists who went to that part of the country with the intention of commencing sheep farming would be exceedingly disappointed, because even in the more favorable island of Timor, which closely resembled Australia in its physical characteristics, the sheep had no wool and lost their fat when introduced. Therefore, said Mr. Wallace, if the wool turned to hair, and if the fat went away, he did not see how sheep farming could be carried on with success. A similar opinion was expressed at the same meeting by Mr. Crawford, who spoke decisively as to the unsuitability of the climate to the pasturing of sheep. These gentlemen seemed entirely of the opinion which Mr. Earle expressed in his 'Tropical Australia,' published in 1846, that the soil would produce almost anything, but that wool-bearing animals would deteriorate from the moment of their introduction.

"Now, in opposition to these theories, there existed a few facts, which, if not conclusive, were certainly important. In the first place, Mr. Wallace's statement that European wool-bearing animals could not exist within the 15th degree of south latitude, is met by the fact that flocks of sheep had for a long time been depasturing within that latitude. Statements had been received from Queensland, showing that upon runs lying in about the same latitude (15° S.)

as that of Victoria river, sheep farming was being *carried on with success, and that no deterioration had been observed in the quality of the wool* there produced. It had been remarked, indeed, on this point by Sir Charles Nicholson, that at this very time there were *upwards of a million of sheep* in the highest possible condition being pastured within the tropics. Another fact of some little importance was that Mr. Augustus Gregory took sheep with him to the Victoria river, (in his expedition to the Northern Territory,) which river is in 15° south, and kept them there for many months during his exploration of the country in 1856. He observed no falling off in the state of the animals, and in his report he spoke in the highest terms of the country as a pastoral region. But there was a more recent case than this in the experience of the explorer, Mr. McKinley, who took sheep across the island from South Australia to the Gulf of Carpentaria without any inconvenience, and certainly the wool of these did not turn to hair, for Mr. McKinley brought back the fleeces of several of them, in order to show that the climate had produced no injurious effects. Mr. McKinley, writing upon this subject, said: 'I perceive no difference in the quality of the wool, but knowing the impression on some minds that wool suffered injury in hot climates, I was the more particular in satisfying myself that such was not the case, by bringing back with me two of the sheepskins, which may now be seen in the office of the Crown Lands Commissioner.' This statement was certainly useful as far as it went. The facts, then, showed that wool was now produced in tropical Australia, and that the northern part of Queensland was becoming every day more and more occupied by sheep.

"Mr. Magarey stated that he knew by experience that at Rockhampton, in Queensland, the climate was very hot, but he believed no change was observable in the sheep depastured there—at least no change that could not be accounted for by other causes. Mr. Wells remarked, 'that with regard to Queensland, the Gilbert, the Lynd, and the Mitchell rivers were as far north as the Victoria, (15° S.,) yet portions of the country were said to be successfully occupied by sheep farmers. Wool had long been grown in India.'"

This important subject of the influence of a tropical climate was openly and freely discussed before the society referred to; and from all the facts advanced the society was convinced that fine wool could be successfully produced in the tropics. I have taken advantage of every opportunity to collect facts from experienced persons relative to the influence of the tropical regions of Australia in affecting the fleece or staple of sheep; and I have no hesitation in stating that the wool does not become changed to hair; and, on the contrary, that where careful selection is made for stock purposes, the staple retains its fineness, and in some cases has improved. I have repeatedly noticed letters published in the Melbourne papers from parties in Queensland, with regard to the adaptability of the tropics for the production of fine wool, and the statements made have always been favorable. In Queensland you will find the orange, pineapple, plantain, and the finest wool merino sheep, flourishing in adjoining fields. The only objection which I have heard urged against the tropical portion of Australia for the production of wool is the fact that the fleece becomes thinner, losing in time about 25 per cent. of its weight. Again, in very hot seasons, when the hot winds have prevailed, the surface of the fleece presents the appearance of having been singed by a hot iron.

I cannot resist the temptation of quoting a passage from the able ornithologist, Mr. John Gould, who says: "The thermometer frequently rises to 110°, 120°, and even to 130° in the shade; and this high temperature is not unfrequently increased by the hot winds which sweep over the country from the north. A drought of many months' duration sometimes occurs, during which the rivers and bayous are dried up, and the land becomes a parched waste. Vegetation is burnt up, and famine spreads destruction on every side. The indigenous

animals and birds retire to the mountains, or to more distant regions. Thousands of sheep and oxen perish; bullocks are seen dead by the road-side, or in dried-up water-holes, to which, in the hope of relief, they had dragged themselves, there to fall and die."

To establish the fact that wool can be successfully produced in a hot and arid region, where there is a scant supply of feed and water, I shall quote at length a letter published in the Adelaide Register, of September last, referring to the writer's observations in Sturtland, 25° south latitude, heretofore described.

THE NORTHERN PASTORAL DISTRICTS OF SOUTH AUSTRALIA.

Mr. Tomkinson, of Adelaide, thus writes to the Register: "Having just returned from the district in the neighborhood of, and north and east of Port Augusta, I regret to say that a large portion of it is as bare as the Desert of Suez; there is absolutely no feed except what the stunted salt-bush affords. The prospects for the coming summer are as bad as they can be. Up to Sunday, the 14th of August, the rains of winter had not fallen; heavy clouds and light vapory showers have prevailed for the last three months. Grass is here and there showing thinly, as it usually does at the end of April, but there is no bite for stock. In the space from Mount Brown to Mount Eyre on the west, and from Chase's Range to Pekina Hill on the east line, I could see the dry, gray and red signs of a parched country. On the plains of the Willochra, columns of dust might be seen stretching from Pichirichi creek to the base of Sugar-loaf Hill, at Kanyaka. On the vast western plains the same feature. The Crown lessees are alarmed for the safety of their flocks and herds during the summer. The lambing generally was satisfactory, but the deaths have so reduced the numbers that a very light clip of lamb's-wool must be the result. The sheep everywhere are being watered as though it were the height of summer. Success in well-sinking is almost a matter of life and death. It is being vigorously done, yet one-half the number are failures. The average cost of each well may be put down at £250. Water has to be carted distances of ten to twenty miles for the men engaged in these operations, and to the various huts on the runs besides. The expenses may be imagined. It will take several years of downright good seasons to replace this extra outlay. Cartage for rations, wool, &c., is another serious lookout for the stockholders. The time of shearing is close at hand, but the usual force of teams has vanished. Poverty of feed and ill usage have produced disease among the working bullocks. Starvation and death have succeeded. I saw plenty of drivers, drays, and whips, but the workers were wanting. A string of a dozen loaded drays started from Port Augusta to Mount Deception, &c., but the men said they had little hope of reaching their destination. On the third day's journey their beasts began to drop out. This is all the more serious because many of the stations are short of supplies. There will probably be great distress in the north on this account. Either horse-teams or pack-horses must be employed, unless relief from saturating rains comes forthwith. In fact, a wet shearing, usually so much dreaded, is now looked for by the squatters north of Mount Brown as their only chance. I do not think that the state of things which I have described without exaggeration is known to the general public. I therefore write these lines believing that the information may be of interest, feeling sure that sympathy will be shown for those enterprising pioneers of the outside districts who are bravely facing an adverse season, great losses, and extraordinary difficulties. I believe that the camel is the only beast of burden upon which dependence could be placed in a season like the present, and should like to see parliamentary aid granted to the first hundred imported with men accustomed to them."

SHEEP THRIVING ON DESERTS.

In noticing that portion of the island situated between 25° and 30° south latitude and 135° to 145° east longitude, I fear that my statements may be deemed exaggerations. I shall freely quote from the work of Mr. Jessop, (London, 1862,) and from the narrative of Captain Sturt, (London, 1849.) I must admit that the whole of Victoria and South Australia is not of the same inhospitable character as that described by Captain Sturt; but that the district described by Mr. Jessop is used for the production of wool, and that the whole of the country within 200 miles of the furthest point north attained by Captain Sturt is at present occupied. My object in referring so particularly to this district is to show that the most barren portions of the northern States can be profitably applied to the production of wool; and that the piney barrens of the north are gardens when compared with inhabited Sturtland.

No one, unless he has been a resident of Australia, can form any idea of the intense heat, or the total absence of moisture in the atmosphere. At page 305 Captain Sturt states, "On the 14th we tried to ascertain the dew-point, but failed, as in previous instances, nor was I surprised at this, for during our stay of nearly four months at the depot we have never experienced a dew. In an air so rarefied, and an atmosphere so dry, it was hardly to be expected that an experiment upon it (the dew-point) would be attended with its usual results, or that the particles of moisture separated could become condensed by ordinary methods; the mean of the thermometer for the months of December, January and February having been 101°, 104°, and 101°, respectively, in the shade." At page 313 he refers to what seems to have surprised him, and remarks, "On the night of the 20th of April we had a heavy dew, the first since our departure from the Darling."

At page 230, volume 1, Captain Sturt refers to the heat on January 2, and states, "The ground became so heated that the bullocks pawed it to get a cold bottom every time they stopped to rest. The upper leather of Mack's shoes were burnt as if by fire. The dogs lost the skin of the soles of their feet, and poor Fingal (a Scotch stag-hound) perished on the road." But what I would especially direct attention to is the clear and distinct statement of Captain Sturt in connexion with the above: "Amidst all the sufferings of the other animals the *sheep thrived well. Their fleeces were as white as snow, and some of them were exceedingly fat.*"

In his volume on Sturtland, Mr. Jessop refers to Arquala, a station supporting 30,000 sheep, and states: "Arriving at the station at 7 p. m., we stopped at the hut of the overseer, from whom we got directions where to place our horses that they might forage for themselves. We led them across the creek, to what the overseer described to us as a grassy flat. The description was true enough as to the flat, but as to the grass, all that can be said is, that though it looked green by moonlight, yet when I went upon my knees to test the reality of the vision, I was only able to find a blade here and there." Yet this was the best pasture upon a station supporting 30,000 sheep—an oasis specially kept for the benefit of travellers and favorite horses.

At page 32 Mr. Jessop refers to the Pintha station, and notes the absence of water and pasturage in the following language: "The average of lambs raised amounted to but 30 per cent., and was accounted for on the fact that the run is a poor one. The ewes were literally starved to death, while others had no milk for their offspring." At page 33 he says: "Not only is Pintha a good specimen of the country by its arid and barren aspect, it has also another property in common with it, in its brackish water. In the middle of the creek is the well which supplies the station with water. I had detected nothing amiss when drinking tea, yet upon taking my horse to the well nothing could induce him to drink, and rather than taste the brackish water he chose to start on his

journey with a dry throat. By referring to a large map of Australia you will find lakes, rivers, and creeks laid down, but this is no evidence that they contain water." In describing the Pintha station Mr. Jessop says: "As a rule throughout this region, the head-station or residence of the proprietor is always by a creek, or where there is water. If there is no water in the creek, which is mostly the case, a well is sunk in it, and generally proves successful. So here, running through the plain and close by the station, is a creek with an enormous bed, deep and wide. It unites further up with Spring creek, and then the main, keeping under the range, is lost in the distance. Such creeks are distinguished not by their water, which they exhibit but once in a series of years, but by the huge, green trees (eucalypti) which line their banks."

Referring to Pekina, a run still further north, Mr. Jessop states that "it carries 70,000 sheep, the average weight of the fleece being five pounds; the market price of the wool but twenty-five cents, in consequence of the amount of dust it contains; expense of producing the wool about eight cents per pound, giving a profit to the owner of about $55,000 per annum."

Here is a barren region, far distant from market, which, but a few years since, was an inhospitable wilderness, nay, desert, and which has been rendered productive and profitable. About the year 1849 this run was purchased for $200, as it was considered useless. At the time of its purchase, remarks Mr. Jessop, "little was known of Sturtland, and that little was evil. The Pekina run was thought useless, because it was absolutely destitute of water everywhere. These places, which have a run of water, were then dry, with no sign of moisture. That it should now have water is owing to sheep treading the ground in the creeks to firmness, so that the rain, instead of percolating and running off, is detained in hollow surfaces."

To illustrate still further the inhospitable character of the region just referred to, I shall quote still further from Mr. Jessop: "About six years before, (1855,) a laborer, named Palmer, was crossing from one run to another, (Warconie to Kanyaka,) only fifteen miles; yet such was the fearfully hot state of the weather, and impossibility of getting water on the way, that he dropped from exhaustion." At page 106 he refers to the death of a man named Hammond, "who was merely crossing the space intervening between these runs and lost his life." The mention of these two accidents, which are but two out of many, may serve to show the fearful position of a man when only a short distance from water, or exposed to the fiery wrath of the summer sun upon a plain where there is no shelter. But experience illustrates better than words; and much as I tried to imagine the hardships of poor Coulthard, who, a year before this, and somewhat in the same direction, was so exhausted that, after drinking the blood of his horse, he had just strength enough to scratch upon his canteen the wretched words that "now his tongue was swollen so that he could scarcely breathe; now his eyes got dim, so that he could not see; and now"—the faint marks showing that he could not write; his hand was being grasped by another hand—the hand of death. In describing this locality, (Kanyaka station,) Mr. Jessop states, "There appeared some signs of verdure where the coppices of small gum-trees, closely beset with underwood, fringed the creeks, or formed a phylactery about the hills; but the ground was melancholy to look at—so much hard and dry sand being covered with so little vegetable life." At page 297 Mr. Jessop assures the reader, "that nothing tells so plainly the nature of the country and climate as these cases of men lost in the bush. The merchants told me of fifteen men whom they had known to perish thus miserably in the space of six years, and all in the northern part of the colony."

The facts referred to will prove that sheep do not require artificial grasses; nay, that they will live and thrive without grass. In the interior of this colony there are but few genera and species of plants which will withstand the dryness and temperature, and upon these few sheep feed.

One who has been accustomed to raise sheep upon land affording pasture for three or more sheep to the acre would exclaim, "It is impossible that sheep can succeed where there is so little food; and that the exertion necessary to find sustenance would keep them poor and prevent the growth of wool." No one, unless he has been a resident of Australia, can form any idea of the physical endurance of sheep, their ability to stand hardship and exposure, and the distance they can travel daily. To illustrate the power of endurance and ability of sheep to find nourishment under any and all circumstances, I shall refer to Mr. John McKinley's experience. He was the first Australian explorer who succeeded in crossing the island from south to north and live to tell his own tale. To supply his party with food he provided a number of sheep. In conversation he assured me that he had frequently driven them from fifteen to thirty miles per day, and on one occasion thirty-five miles; and they kept in condition, averaging nineteen miles per day.

A few days since I questioned Mr. Thomas Shaw, jr., with regard to the deterioration of wool in hot climates. From observations on his father's run, and that of others, in Queensland, he assured me that the wool had in no way deteriorated in fineness, length, or quality. Yet Queensland is the northeast portion of this island, between 14° and 30° south latitude. In speculating on any question the only safe guide is experience. In corroboration, I shall quote from a letter of Mr. Bourne, published in the London News. This gentleman was second in command of the Landsborough expedition, which crossed from Queensland to the Gulf of Carpentaria. Mr. Bourne remarks: "The theories of science have repeatedly broken down when put forward to explain its anomalous phenomena. What old colonist does not remember the prophecies uttered by scientific men in New South Wales when Moreton Bay (now called Queensland) was first occupied by squatters? It was then confidently asserted that sheep stations would not answer so far north, because the fleece degenerated when grown beyond a certain degree of latitude, and that all attempts to grow wool there would signally fail; and yet experience, the only true test, has proved that fleeces of the finest quality are produced in Queensland, despite its high temperature. Probably the hottest parts (both day and night) of Australia are the Darling, the Bogan, and the Macquarrie, where Sir Thomas Mitchell found the thermometer to range from 90° to 127°; yet even there wool is most profitably grown.

The best sheep which I observed are the pure descendants of an importation of pure-bred Saxons from the Elector's flock. They have been carefully protected from the influence of foreign blood. In size, length of staple, and weight of fleece, they excel their parents. Why is this? Simply because care has been exercised in breeding, and a hot and arid climate has stamped the sheep with its own characteristics. The wool of these sheep is completely changed in character, and greatly improved, both in quality and quantity. The fleece is made heavier by the staple having become much longer and stouter, the fibres more dense, finer, and freer, with a superior degree of softness, elasticity, and pliability; whilst the milling qualities are equal, if not superior, to those of their original parents in Spain. The change is so great and complete, both in carcass and wool, that the animal can no longer be called Spanish merino: it is, *par excellence*, the Australian merino.

STATISTICS OF AUSTRALIAN WOOL.

Before entering into details with regard to the production of wool in Australia, I shall, as briefly as possible, refer to the amount produced. In 1807 there were exported but 245 pounds of wool of a very inferior character, which in 1835 increased to 3,776,191 pounds. The yearly increase from this date was

uninterrupted until 1842, when the amount suffered a diminution; but in the succeeding years the figures resumed their onward course. Thus:

1843	lbs. 17,433,780	1854	lbs. 47,489,650
1844	17,602,247	1855	49,142,306
1845	24,177,317	1856	52,052,139
1846	21,789,346	1857	49,209,655
1847	26,056,815	1858	51,104,560
1848	30,034,567	1859	53,709,542
1849	35,879,171	1860	59,166,616
1850	39,018,221	1861	68,506,222
1851	41,810,117	1862	71,339,092
1852	43,197,301	1863	77,173,446
1853	47,076,010		

The gold discoveries scarcely checked the progress of production for a moment. Comparing the production of 1851 with 1863, there is an increase of 35,363,329 pounds, or 84.69 per cent. Assuming (which is not improbable) that a similar progress is achieved during the next twelve years, the exports of Australian wool in 1875 will reach the enormous aggregate of 112,536,775 pounds.

In connexion with this subject I may briefly refer to the progress made in wool-growing in some of England's southern colonies. The production of wool in South Africa has risen with singular uniformity, from 2,197,143 pounds in 1844, to 8,223,598 pounds in 1854, and to 20,166,617 pounds in 1863. British India is also becoming an important point of wool production, having effected the following strides in this matter in the last two decennial periods: In 1844 the amount of wool exported was 1,916,129 pounds; in 1854, 14,965,191 pounds; in 1863, 20,670,111 pounds.

In comparing the whole wool exports of three southern English colonies in 1844 with those of 1863, we arrive at an increase of 96,294,655 pounds, to which increase the three colonies contribute as follows:

Australia	59,571,199 pounds.
South Africa	17,969,474 pounds.
British India	18,753,982 pounds.

SHEEP FARMING IN THE PAMPAS.

BY REV. G. D. CARROW, LATE SUPERINTENDENT OF THE MISSIONS OF THE METHODIST EPISCOPAL CHURCH IN SOUTH AMERICA.

PAMPA FORMATION.

THE term Pampa, signifying an extensive plain, is marked in the Spanish dictionaries as a *South Americanism.* It is probably derived from the *Quichua,* one of the numerous dialects spoken by the Aborigines of the southern continent. The country to which the term is applied extends from the Bolivian province of Chiquitos to the confines of Patagonia, and from the western margin of La Plata to the eastern slopes of the Andes. It embraces an area north and south, of eight hundred, and east and west, of one thousand miles. The banks of the streams, in the northern portion, are skirted with trees and a dense undergrowth; and in "*El gran Chaco,*" an unexplored territory, still inhabited by fierce Indian tribes, are produced various species of the finest and

most valuable timber to be found in the New World. By far the largest part, however, of this vast extent is an open plain. A careful examination of its geological features has led to the conclusion that it was once submerged by the sea, and is of comparatively recent formation. Geologists seem to unite in the opinion that it was formed by a combination of natural forces, consisting of alluvial deposits from the mountains, and an upheaval of the bed of the ocean. "As far as we yet know of it," says Sir Woodbine Parish, "the whole of that vast plain or level called the Pampas, extending from the eastern slopes of the Andes to the shores of the Parana and Uruguay, appears to be one immense bed of alluvial matter, consisting almost throughout of the same red-colored, argillaceous earth, containing calcareous concretions, more or less indurated, the deposition of detritus brought down by innumerable rivers from the Andes, which has in the long lapse of ages been poured out, perhaps, over the shallow bottom of an ancient sea, subsequently upheaved with this its superincumbent stratum. Some such process of formation appears still to be going on in many parts of the Pampas, where muddy streams, and streamlets, descending from the mountains in the rainy seasons, and too sluggish to force a way through the level country, inundate the plains, and gradually deposit the alluvial sediment in the swamps and morasses, until accumulation of fresh soil takes place in sufficient quantity to throw off the waters again in some other direction." Speaking of a possible change in the course of the great river itself, the same author says: "Every observation tends to the inference that this mighty estuary may, centuries hence, be filled up, and then form one great delta like those of the Nile, the Indus, and the Ganges. Nor may this require, perhaps, so long a period as might at first be imagined. If we except the narrow channel between the Cluco and Ortiz banks, below Buenos Ayres, the average depth of the river between that city and Montevideo does not exceed twenty feet. The prodigious quantity of mud and detritus brought down is well known, the whole river being at times discolored by it. Now if but enough of this sediment is deposited to cause the small annual increase of only half an inch in the bed of the river, it will not require five hundred years to constitute one vast bed of new soil, which will be nothing more nor less than an extension of the alluvial formation of the Pampas."

Mr. Bland, one of the United States commissioners to Buenos Ayres in 1818, says: "The Pampa formation may have been gently lifted just above the level of the ocean, and left with a surface so unbroken and so flat as not yet to have been sufficiently purified of its salt and acrid matter, either by washing or filtration." Commander Page says: "What the amount of this deposit has been we are left to imagine. Little doubt, however, can be entertained but this filling has been, and still continues, the silent work of time, and that each day as La Plata pours its sea of waters into the ocean, layers of mud and vegetable matter sift to its shallow bottom." No one who has examined the phenomena will question the correctness of this theory.

TOPOGRAPHICAL FEATURES.

It is not so much of the Pampa country at large, however, that the writer would speak at present, as of that particular portion of it which is included within the limits of the state of Buenos Ayres, and three or four of the adjacent provinces. The surface of this vast territory is one continuous plain, with scarce an undulation to break the dead and boundless monotony. The floods which the snow-capped Andes shed in the spring are gradually absorbed, until losing the concentrated force of mountain torrents, they spread themselves out in shallow lakes on the plains, and evaporate in the rays of the summer's sun. So completely absorbed are the mountain snow floods of spring, and the winter rains appearing with the southeast winds, which then prevail, that there is not a single river in all the wide territory of the state that is navigable more than

a few leagues from its mouth, and that only during the winter and spring seasons. The sun, apparently, rises out of and sinks in an ocean of grass, with hardly an object to cast one speck of shadow on the boundless sea of verdure, and silence, profound as that of the grave, reigns throughout the entire scene.

THE SOIL.

The surface soil has, generally, the character of a somewhat adhesive, bluish black loam, from twelve to thirty-six inches deep. Under this there is a yellow sand stratum of harder consistence and again below this there is, throughout extensive tracts, what the Spaniards call "*tosca*," a coarse reddish yellow clay, so completely indurated as to resist the stroke of pick and spade, or filtration of water. This formation is usually found at a depth ranging from twelve to twenty feet, at which point of descent water, clear and slightly brackish, is obtained in exhaustless abundance.

ORIGINAL INTRODUCTION OF SHEEP.

The first sheep domesticated on the eastern side of the mountains were purchased in Peru, and brought to Paraguay by Don Domingo Martinez de Yrala. This true and brave-hearted adventurer was the first to open communication between his countrymen on the Atlantic and Pacific coasts. The attempt had several times been made, and had as often resulted in failure, attended with severe suffering and loss of life. In the month of August, 1548, Yrala, then governor of Paraguay, renewed it, and succeeded in reaching the Peruvian province of Charcas, now Chuquisaca, in Bolivia. From this point he sent forward a trusty messenger to apprise Don Pedro de La Gasca, viceroy of Peru, of his arrival. La Gasca received the messenger kindly, but sent him back to his master with a prohibition against any further advance into the country. The explorers were in search of gold and silver, but instead of supplies of these precious metals, they returned with 12,000 Indian captives, whom they enslaved, and a small flock of European sheep, as a breeding stock for future supply of food and clothing. The stock, however, from which the numberless herds of pampa sheep have descended, was introduced in 1590 by Juan Torres de Vera y Arragon, who, to fulfil an obligation entered into by his father-in-law, Juan Ortiz de Tarate, brought four thousand sheep from Charcas, which were divided between the provinces of Santa Fé, Corrientes, and Buenos Ayres. The general supposition is, that the flocks introduced at that time were of the *churra* breed from Spain, the fleece of which, as the name indicates, was coarse, long, and of inferior quality. Spain was always jealous of her *merinos*, and strictly prohibited their exportation, even to her own colonies. In spite, however, of government edicts and official watchfulness, a few were, from time to time, smuggled into the South American provinces. Some of these could be identified at a period so recent as the close of the last century, but they at last entirely disappeared among the coarse and inferior breed originally introduced into the pampas from Peru. The descendant of this stock, or common pampa sheep, has a coarse, thin fleece, and is ill-shaped, long-legged, lank-bodied, and exceedingly difficult to fatten. Fifteen years ago this breed could be bought at fifteen cents a head at a distance of three hundred miles from the city of Buenos Ayres. The wool was not worth the expense of conveyance to market, and the flesh was rejected as unsavory and worthless both by native and foreign inhabitants.

IMPROVEMENT OF THE NATIVE STOCK.

The first attempt, from enlightened conviction, to improve the native breed was made by an Englishman, Mr. Thomas Lloyd Halsey. This gentleman

visited Spain in 1814, and, notwithstanding the vigilance of the government officials, succeeded in carrying out of the country thirty-five head of fine merinos. He smuggled them acoss the Spanish frontier into Portugal, embarked them at Lisbon for Rio de Janeiro, and from that port reshipped them on a Portuguese vessel for Buenos Ayres. By the time they reached their destination they had cost their proprietor $150 per head. For a time everything promised well. The pampa climate proved so favorable that the original thirty-five increased to four hundred in five years. But at the close of the fifth year of his experiment Mr. Halsey lost the whole of the well-earned fruit of his labors. A fire broke out in which the whole flock, except thirty-three, was consumed. Discouraged by the disaster, Mr. Halsey abandoned his enterprise; the remaining thirty-three passed into other hands, and perished amid the robberies arising out of the unsettled state of political affairs, leaving no trace of their existence on the flocks of the country.

After this misfortune no further attempt was made to improve native sheep until 1824. The government then took the experiment, and through an agent, M. Terneau, of Paris, imported about one hundred merinos, some of which were from the flocks of the French government farm at Rambouillet. Shortly after their arrival, the government being wholly occupied with less profitable schemes, these fell into the hands of a private native gentleman, from whom they were purchased by Messrs. John Harratt and Peter Sheridan. The price paid for this importation was one hundred silver dollars per head. The purchasers—the former an Englishman, the latter an Irishman—were pleasantly jeered by their neighbors upon the price they had paid for their whistle, and the common opinion was that they were in no danger of being enriched by the interest on their investment. Forming an opinion from the qualities of the native stock, sheep were, at this time, held in very low esteem both by native Buenos Ayreans and foreign residents. The idea of improving a breed of such despised animals met with general ridicule, and was, on all sides, voted a bad speculation. For several years the outlay of Messrs. Harratt & Sheridan was large, and the returns from the flocks were small. During all this time, too, they were obliged to endure the banter of their friends. But the result proved their sagacity and sound judgment. After a trial of five or six years the fruit of their experiment began to appear. The price at which the improved wool was sold in Liverpool market opened the eyes of all parties. At once the demand for improved rams became general and urgent, and the desire to invest in sheep spread rapidly among all classes of capitalists in the country. In two years about five thousand merinos were imported from different countries, and the number would have still largely increased but for a blockade of the republic by France and England. The number of improved sheep has, of late years, been so largely multiplied that the flocks of the country are now, almost without exception, well refined. The wool is now deemed equal to the production of any other part of the globe, and but for the bur which entangles itself with the fleece, would head the list of market prices. Sheep are fast driving out horned cattle, and with all its wealth in elegant woods and precious metals, wool is destined to become the great staple of the southern continent.

FAVORABLE CHARACTER OF THE COUNTRY AND CLIMATE FOR SHEEP-BREEDING.

There is, perhaps, no section of the globe that offers to the sheep farmer advantages superior to those of the Buenos Ayrean and adjacent pampas. The climate is almost all that could be desired. The southwest winds in the first month of spring (September) are occasionally so cold as to destroy lambs falling at that time; but the general temperature even during that season is highly favorable. Nor is the climate less favorable for lambs falling in autumn, for

the lowest temperature is not so severe as to occasion much danger. In mid-winter ice sometimes forms upon small surfaces of still water; in damp places there are thin and evanescent incrustations; and during a few mornings of the season, when the temperature over night has been unusually low, with a gentle wind from the southwest, the northman's eyes are greeted and his heart cheered with that same hoar frost which dyes the foliage, and clothes with a variegated splendor the stately forest of his native land. These, with the chilly, damp, but healthful southeast days, furnish the utmost rigors of the pampa climate. Through all seasons of the year flowers bloom and fruits ripen in the open air, and there is more of pasture, of fresh greenness and beauty, in winter than in summer. No feeding is required at any time, and both for grazing and horticulture the soil and climate afford exhaustless resources.

FLOCKS EXEMPT FROM DISEASE.

In proof of the favorable character of the soil, climate, and pasture, for sheep farming, it may be noted that there is no sheep disease indigenous to the country. Before the introduction of foreign sheep the native flocks were remarkably healthy, being free from foot-rot, scab, and almost every other infection. Not till the arrival of imported merinos, in 1836 and 1837, did the foot-rot appear. When this disease first attacked the flocks it was exceedingly virulent, reducing one-half of many flocks to walking on their knees; but it is no longer formidable. A few sheep become lame after an unusual continuance of wet weather, but a week of dry days suffices to restore a majority of them. A very little attention will preserve a flock entirely free from disease. "*The scab*," says an experienced writer, "was introduced (it is thought from England) at the same period, and occasioned considerable alarm among the sheep-breeders. But this also is dying away. A few sheep with broken fleeces are seen a little before shearing, in August or September, but the disease is fast disappearing, and it was seldom fatal to the animal in its worst stages."

PASTURE EXCELLENT AND UNFAILING.

The verdure of the pampas is perennial, consisting of a very numerous variety of plants and grasses, a classification of which I have not been able to find. Some of them, however, I can identify from memory. Three of the pampa grasses in which the sheep farmer is most interested, are the smooth-stalked meadow or spear grass of our country, *(póa praténsis,)* the meadow foxtail, *(alopecùrus,)* and a species of clover—I think *trifolium campéstre*—bearing a bright yellow flower. The spear grass and foxtail are perennial, and seem to be preferred by sheep to all others. The former is specially important in mid-summer. The green of the great plains is then frequently changed to brown. The abundant verdure of the other seasons is shrivelled and scorched by the sun's fierce fires, till it falls to dust, and is swept away in clouds on the wings of the wind. Then beneath the shrunken and crisped leaves of the thistle, which covers extensive districts throughout the pampas, appears the meadow or spear grass, fresh and tender; and the sheep knowing well what is to be found there, take to the thistle grounds, and feeding chiefly there, are preserved in better condition than during any other season of the year. The *trefoil* flourishes most in winter; sheep do not like it, though they will eat it, if their favorite grasses are not to be obtained in quantities sufficient to appease their hunger. It is this plant which occasions the one great deduction from the claims of the pampas as sheep-farming grounds. Its brilliant yellow flower is succeeded by a bur, the spikes of whose prickly coat, dried and hardened by the summer's sun, become as strong and sharp as pointed steel. As this prickly coat hardens, the stem softens and decays, and the flocks in search of food detach the bur which speedily becomes matted in their fleeces.

The fleeces of all flocks are more or less thus affected, and those which are not guarded against unlimited intrusion upon the grounds of the trefoil frequently take up an amount of bur that would weigh as much as their wool. This is the bur which the natives call "*carretilla*," signifying a little cartwheel. The comparison is not very apt, as the wheel is round only on its edge, and the bur, like a bullet, is round on its whole surface. No machinery has ever been introduced into that country for taking out the bur, and such is the trouble and the expense of extracting it in the countries to which the wool is exported, that it deducts from the export *fifteen* or *twenty* per cent. of its value. Whether the trefoil is so abundant or so tenacious in its hold on the soil as to render abortive or too expensive all attempts to destroy it, is a question to which no certain answer can yet be given. My impression is, that increase of population, division of farms, improvements in sheep-breeding, and, as a consequence, a more spirited and general competition, will lead to efforts for the abatement of this *nuisance*, and that they will succeed.

SIZE OF FARMS.

Sheep farms vary in extent from one to fifty square leagues, the square league containing 5,760 acres. A farm of one square league will sustain twelve or fourteen flocks of one thousand each. If the farms were enclosed and divided into fields, so that the flocks might be shifted from one to another, at proper intervals, they would of course sustain a largely increased number of animals. It is beginning to be a question among the farmers whether it would not pay them well thus to enclose and divide their lands. Indeed, a few of the most intelligent and enterprising have already initiated the experiment. Foremost of these are Messrs. Halback and White, and Messrs. Hale and Spring. The two gentlemen last named are citizens of the United States, who have long resided in Buenos Ayres without losing one spark of their love for their native land, and by their intelligent and well-directed energy have done much to enhance the great interests of sheep-breeding in that country, and at the same time have, by their highly honorable bearing in all their transactions with the natives, illustrated beautifully the best type of the national character, and shed a pleasing lustre on the American name. These noble countrymen of ours own an extensive *estancia*, (i. e., sheep farm,) in the management of which they have introduced many improvements, and among others, as before said, those of fencing and dividing into separate enclosures, So far as fencing has been resorted to for any purpose in the country, the material generally used is wire. But there are other materials, of native growth, which, while requiring more labor and expense at first, would be far more permanent, and probably, in the end, cheaper than the wire fence. These are the *American aloe*, and a thorn-bearing bush called *napandai*. The mode of fencing with the aloe is to throw up an embankment about two feet high, and three at the base, and then plant a straight line on the top of the ridge. The plant shoots up vigorously, spreading out its great leaves, which have an irregular and somewhat prickly edge, and the thickness through of a double ply of the stoutest sole-leather. In seven years it flowers, then dies, and reproduces itself from the seed which it sheds in its fall. Many of the gardens and orchards in the suburbs of the South American cities are thus enclosed with the aloe. The *napandai*, if I remember correctly is obtained from its seed pretty much in the same way. The thorns on the limbs of the bush are slightly crooked at the end, and all incline inwards toward the parent stem. The thorn-bearing branches shoot out in all directions from their stem, and woe betide the animal that, distinguishing the *lucerne* or other enticing growth within, attempts to force an entrance. When it has reached and failed to force a passage between the closely planted stems, it endeavors to withdraw, it is caught on the hooked points of the thorns, and it will inevitably

in its change of base, leave behind no small share of its hair or wool. The same animal will hardly attempt a raid across the same or a similar hedge a second time. This thorn is found as far down towards the end of the continent as the thirty-eighth or fortieth parallel of south latitude, and I can think of no reason why it would not flourish in almost any of the States of our federal Union. If it would, it would equal in beauty, and exceed in value, any of the thorns known to American agriculture.

GENERAL MANAGEMENT OF A SHEEP FARM.

It will be proper to say something now of the general management of sheep farms. The farmers usually divide their sheep into flocks of a thousand each. In a very few instances a flock is permitted to grow to the size of two, and even three thousand, and is kept up to that number. But the prevailing rate of increase being about thirty-three and a third per cent., a flock of a thousand having doubled itself in three years is, at the end of that time, divided into two. In this way flocks continue to be multiplied until, in some cases, two hundred thousand sheep may be seen feeding on a single farm. If flocks are allowed to exceed the number of a thousand or fifteen hundred, the proportion of loss in lambs is largely increased. The very young and feeble lambs are, in such a case, much more likely to lose their mothers and perish for lack of nourishment, or to be trodden to death beneath the feet of the older and stronger sheep.

The annual loss in lambs has heretofore been from *ten to fifteen per cent.* This is a heavy percentage, and has resulted mainly from two causes. First, for several years after the improvement of the breed of native sheep had been successfully initiated it was exceedingly difficult to prevail upon the shepherds to take proper care of their flocks during the lambing seasons. This difficulty arose mostly from the circumstance of their having been all their life long accustomed to regard sheep as of little or no value. The second cause of heavy loss by death is found in protracted periods of cold wind and rain which not unfrequently occur just at the lambing season. A week of rainy weather, followed immediately by a chopping round of the wind to southwest, will destroy large numbers of the more feeble lambs in a few hours after their fall. Since the marked progress that has been made in the cultivation of sheep of late years, the farmers began to ask themselves and each other the question whether a little money spent in covered sheds for their flocks would not be a profitable investment. The gentlemen to whom special reference has been made with regard to the enclosure of their farms have also included among their improvements covered sheds, with the open sides facing to the northeast, which is the sunny quarter, and then closed to the southwest, which, in that climate, is the quarter whence to look for driving rains and piercing winds. So far as I know, with the exception of these two instances, no effort has been made to afford proper protection to the young of an animal that constitutes the chief wealth of the country.

As there is no necessity for feeding, the sheep of the Pampas require comparatively but very little attention. One man, assisted by a small boy, can do all the work essential to the proper care of a single flock. The ordinary conditions of agreement between proprietors and shepherds are few and simple. If the shepherd's compensation for his services is to be an interest in the flock, the customary stipulations are that he shall bear the expenses of superintending and shearing; shall take from his charge meat sufficient for himself and family, and shall receive one-third of the yearly increase of lambs and wool. On the other hand the proprietor is obliged to furnish pasture for the flock, a pen to fold it in, and a house for the shepherd and his family. The contract between the parties is generally made for three years. At the end of that

time, if the shepherd has conducted himself well and taken care of his share of the annual profits, he is able to purchase the half of a flock. As half owner, he is entitled to all the privileges of his first contract, pays only half the expense of management and shearing, and receives half of the wool and of the increase. The product of wool is divided annually, and the flock at the end of the contract. In this way a laboring man soon becomes a small proprietor, and as the increase of his means may justify he proceeds to purchase land, and at the close of a period of ten or fifteen years finds himself an independent *estanciero,* with a career open to a handsome fortune, if his life be not cut short in the midst, nor his flocks swept away by the armed bands of robbers that prowl about the plains during all periods of political revolution. The majority of native proprietors adhere still to horned cattle, leaving the business of sheep-breeding to foreigners. Many of the English and Scotch immigrants adopt it, while the Irish take to sheep almost without exception.

PERIODS OF LAMBING.

The ewes lamb once a year, some in March and April, but by far the greater number in September and October; the seasons being exactly reversed, considered with respect to their order in our own country. September and October are the first two months of the Pampa spring, and thus is the season in which ewes generally cast their lambs. The average age to which sheep are thought to attain is by some said to be from seven to ten years. But, strange as it may seem, the question of age appears not to have been noted with any care, even by the most intelligent breeders, so that the writer feels some hesitation to attempt an answer in the absence of accurate and positive information.

SHEARING SEASON.

The shearing season is in October and November. At the period of general clipping the flocks are driven into a large pen, formed of stakes driven into the ground, and interlaced with thongs of raw hide or rods of wire. Within this outer fold there is an inner one, with open door or gate, and so small in dimensions as to admit only a few animals at a time. In this they are caught and tied without trouble. Men do the catching and tying, and the native women of the places the principal part of the shearing. Three men will catch and tie about as fast as thirty women can shear. Each shearer is provided with a dried cow or ox-hide, on which the sheep is laid, in order to protect the fleece from the dirt and litter of the fold. An expert woman shears from eighty to one hundred animals per day, and receives for her wages about one dollar and a half, silver currency. The shearing season in that country corresponds somewhat to harvest time in this, or it may be said to bear a closer resemblance to a scene that might be presented by a combination of our present wheat harvest and our old time corn huskings into one. The housewives and their cooks make special and quite extensive preparation for the meals of each day. The shearers address themselves to their work with a will; stories are told, and jokes between the sexes are freely exchanged. After the labors of the day, in some instances, the beautiful evenings are employed in dancing to the thrumming of the guitar. Like all the pleasant of this mortal life, the merry season quickly passes, and the lady shearers, taking horses, troop off to town or city and expend their earnings for such articles of taste and ornament as may serve to augment the power of their charms during the remaining seasons of the year.

Sheep are sheared but once a year. This is not in accordance with the rule which obtains in some other sheep-producing countries. The custom is to shear twice a year in California and Cape Colony. Perhaps the flocks of the Pampas would also bear two clippings; but breeders there, considering the wet and pierc-

ing days of winter and early spring, have hitherto deemed it safer to content themselves with a single fleece. The fleece of healthy improved (*i. e.*, Mestizo) sheep will average from three and a half to four pounds of wool in the grease, from which, for washing, the average deduction is about one-third or fourth. The clip, in the aggregate, is sent to market unwashed. A principal reason for this is that the Pampas have no running streams. Water collects only in ponds, and many of these are dry before the shearing season, or if not dry, in a particular district, a single washing would so mix the water with the soil of the shallow bottom that it would defile rather that cleanse the wool.

PERCENTAGE OF PROFIT ON INVESTMENTS IN SHEEP.

To A. Lines Van Blarcom, esq., for many years a resident of Buenos Ayres, but now of New York, a gentleman of superior intelligence and large experience in the wool trade, (to whom I am indebted for much of the special information embraced in this article,) I put the question as to the profit of investments in sheep-breeding on the Pampas, and his reply, in substance, was, that after deducting the rent of pasture land, and all other expenses, the average return from investments is, at least, 18 per cent per annum.

NATIONALITY OF THE IMMIGRANT FARMERS.

There are but few immigrants from the United States engaged in the sheep-farming of the country, and fewer still from old Spain. The old Spaniards who have found their way thither are settled in the cities and towns, where they devote themselves to mechanical pursuits, or become brokers or produce merchants. This to those who are acquainted with the pre-eminence of Spain as a sheep-producing country may at first seem strange. The most probable explanation is, that persons belonging to the Spanish shepherd class but seldom, if ever, emigrate. Their whole life being passed on the great hill-sides or vast plains of their naked and solemn country, they have but little intercourse with people of other professions, know nothing of the advantages offered to honest and faithful toil in other countries, and for these reasons feel no desire to stray from scenes that are hallowed by recollections of their childhood, and that have filled their ripe years with plenty and peace. The immigrant sheep-farmers of the Pampas are, to a large extent, British subjects. A few of the English become great proprietors. In their improved fortunes *some of them* present traits of character worthy of the special consideration of a philosopher. True to the instincts of the whole John Bull race, they set up an establishment, deck their servants out in livery, keep a carriage for Mrs. Bull and the children, and for Mr. Bull a fine saddle-horse, and a cockney gig in which to drive after dinner with some friend of equal respectability; cut all their poor acquaintances; never, in any case, recognize any one, however familiar with his name and character, who labors for his bread, nor exchange salutations on the street with any gentleman, (though they may have met and been introduced to him many times,) whose society they do not propose to permanently cultivate; become exclusively and intensely aristocratic; stride about among the natives in long boots, swallow-tails, satin stock, or white neck-tie, high dickey, stove-pipe hat, fine buckskin or white kid gloves; regarding, meanwhile, their civil neighbors with a sort of silent contempt, or responding to their modest and graceful civilities with a lofty and patronizing air; lounge at the club a part of every day over a bottle of stout port and a copy of the *Times;* give a good portion of every night to whist, or chess, with brandy and water; go to chapel on Sunday mornings that Deity may be honored by their presence, and reminded of His obligations for the worship of dignitaries of so much consideration. Such, in some cases, is their routine of life. The consequences may be easily foreseen. Idleness, big dinners, brandy and water, or brandy without water, do their work after a while.

Inflammation seizes the stomach, travels quickly thence to the brain, or apoplexy strikes down the stalwart frame. In a few days the rich proprietor, who began poor, made his fortune among his flocks on the Pampas, and moved to the city to enjoy his wealth, is as poor as the poorest Briton that ever wandered and died far from the island home of his wonderful and mighty race. *Sic transit gloria mundi.* A'dios Señor Bull!

Of all immigrants to the plains the Scotch, as a class, are the most thrifty and prosperous. It is useless to talk of the shrewdness of a Yankee, if one would indicate thereby superior faculty for making money. In all that relates to mechanical inventions, Yankee shrewdness has outstripped the world, but in the art of making money the shrewdest Yankee alive is no match for the shrewdest Scotchman. With his pre-eminent ability to achieve success, it is to be observed also that good fortune does not spoil him. Mr. Sandy McNaughten turns shepherd on the plains, with nothing but his hands, and his wits to direct them. In thirty years he owns farms, and flocks, and other investments, amounting to half a million; yet he is, in spirit, the same *republican* as when he had not where to lay his head. He could well afford a fine establishment, but declines the expense and trouble of it. He moves to town to educate his children, but takes a plain house, supplies it with plain furniture, and keeps on in the plain old ways of his early life. There is no carrriage. There is no trotter that makes his mile in three minutes. There are no liveried servants. If there be such a thing as *society*, both himself and his spouse and their children know that there is not enough of the genuine thing within their reach to pay them for the cost of a single thought or a single dollar. He walks to church, weighs the doctrine, criticises the argument, sings through his nose, disputes with the minister, takes the sacrament once a quarter, and once a week a *little too much whiskey.* Let him, however, not be censured too severely. The reader is by no means certain that he would bear the same good fortune half as well. Pass on, Mr. McNaughten!

The Irish Briton, as he does many other good things, makes a fortune by mistake—blunders into it, peradventure, through some speculation, in the most innocent way in the world. But, like the princely fellow that God made him to be, he dispenses a liberal hospitality, has a kind and civil word, or a handful of change for a needy countryman or stranger, and a genuine and enthusiastic admiration for the country, and the institutions of Washington, that endears him to every American heart. May the shadow of Mr. Fagan O'Brien never be less!

Wool does not always lead to fortune. It must not be supposed that such high fortune is the *general* award of sheep-farming in the Pampas. It is a little like gold mining in Australia and California, or speculations in *oil wells,* those late discoveries which are to dispense with the sun, and light the world with lamps. The general success does not exceed competency, and among those who never pass that point, and remain for the whole of life out in the plains, the style of living is plain and simple to the last extreme. The house in which the shepherd lives is called, in Spanish, "*El Puesto,*" the post, because it is the rallying point on the farm, and the spot near which the flocks are folded for the night. It is a one-storied building, containing three or four small rooms, having *adobe* walls and roof of thatch, with eaves extending so as to serve the double purpose of roof and veranda. The floor is unpaved or paved with brick. There are one or two deal tables, some wooden chairs and stools, some articles of crockery, a fireplace with its primitive cooking utensils, and bedsteads of raw-hide or canvass sacking with some light covering quite sufficient for comfort in that mild and genial clime. And simple as is the dwelling, equally simple is the family board. Hard biscuit, (baked in town or city,) tea, and fried mutton furnish the customary fare. It is a little singular that so many of the immigrants should content themselves with such simple and unvary-

ing diet. They might have fresh vegetables at all seasons of the year, but will not take the trouble to cultivate them. They might have the most delicious milk and butter, if they would provide a few cows and create the inexpensive conveniences of a dairy, but they will not incur even that small amount of expense and trouble. They rear no domestic broods. And though venison and wild fowl abound on the plains, they keep closely to the daily regimen of tea, hard-tack, and mutton. At certain seasons the traveller in the Pampas, especially as he approaches the Atlantic coast, encounters immense flocks of wild ducks and geese. The water at that time covering the surface to a depth of about six inches, the fowl come in from the coast to feed on certain grasses, of which they are fond, that abound in some localities. They are so numerous that they literally cover the surface of the plain as far as the eye can reach, and, never having been disturbed by the sportsman, are so tame that they will scarcely get out of the track of the horse's feet. On the more elevated parts of the plains the deer and the ostrich are found feeding together. The partridge abounds in every district. Yet, with these delicacies of flesh and fowl before them, many of the immigrant settlers seldom taste any other meat than mutton or beef throughout the year. For this singular failure to appropriate some of the most delicate and delicious articles of food ever furnished by the allwise and bountiful Creator, two reasons may be suggested: First, the example of the natives. Man is essentially an imitative creature, and is as likely to imitate the customs which he despises as those which he admires. Indeed, he is more likely to imitate the evil than the good, if the Bible and the theologians be not mistaken. Now, the natives of the Pampas eat nothing but beef, because their occupation is almost entirely with horned cattle, and it is easier to lasso, kill, and dress a fat steer than it would be to kill a sufficient quantity of wild game to last them for the same length of time. The thing that can be done the easiest is the thing preferred by a people who, perhaps, like the inhabitants of all continuously mild climates, are sadly afflicted with *constitutional laziness.* Secondly, there is something in the very circumstances and employment of the shepherd that indisposes him to desire those delicacies without which life would be as nothing to the pampered voluptuary in the crowded city. Above him is the serene, transparent sky; beneath his feet lies the boundless expanse of grass, stretching all around to the line of the horizon like the sea; silence reigns throughout the peaceful scene; around him are his flocks quietly feeding. The only object to vary the sameness of the view is a company of horsemen galloping abreast with the regularity of trained cavalry. The only event to break the monotony of his life is the arrival of a stranger, who partakes of his hospitality, sleeps an hour, and passes on his way. His labors of personal attention to his flocks are light, and for much of his time he has no serious occupation. Now, under such circumstances as these, it would require unborn tastes to make delicate viands a necessary condition of comfort, and a constitution and energies of extraordinary power not to be affected with that general relaxation which disposes a man to reduce all his habits and customs to the most accommodating standards of ease and simplicity. This is not intended as a plea for laziness and semi-barbarous tastes in their style of living, but merely a statement in explanation of the appearance of such phenomena in certain circumstances of the life of men. And it should now be further observed that, while in many cases of shepherd life on the plains the absence of the sense of refined taste and comfort is strikingly apparent, there are also many in which a superior nature asserts its sway, and achieves a complete triumph over surrounding circumstances. In many a shepherd home are to be seen the pleasing signs of Scotch thrift and English plenty and comfort combined. The house is well built, covered with slate or tin; the walls, of burnt brick, are neatly whitewashed, and the doors and windows painted green. A well-trimmed hedge encloses the yard, within whose circle flowers bloom and

fruits ripen. Vines clamber about the veranda, and fill the surrounding air with the sweet odor of their bloom. To these external signs of taste there are internal arrangements to correspond. The floor is of glazed tiles, or of wood, covered with domestic carpet; the linen sheets and old-fashioned dimity bed-covers are white as snow; the family bookcase stands primly upright in one corner; the modern sofa and rocking-chair confront each other from opposite sides of the best rooms, while on a centre-table lies the well-bound book that was brought across the great water when the newly wedded pair, first setting forth into the world to seek their fortune, had not much else to bring. Within its clasped lids are the records of the marriages, births, and deaths. It has made the family what it is, and will live as a treasured heirloom among the descendants of the household for generations to come. Adjoining this is the dining and sitting room in one, and next in order the kitchen, with its goodly array of flowered queen's-ware and of polished tin. Punctually at twelve dinner is on the table, and all the writer has to say is, (and he speaks now from best experience,) happy is the tired wayfarer who is invited to sit down. If he tarries long enough he will find that the pleasure of eating holds no mean rank among the orders of that establishment. Four meals each day complete the measure; and if the stranger guest be not blessed with Pampa digestion, then so much the worse for him. In most instances, all that unites to constitute such a home in the beautiful desert may be traced to the principles implanted by an early religious education. There, as strikingly as anywhere, will the thoughtful observer recognize the proofs of the great truth that was in the apostle's mind when he said, "Godliness is profitable unto all things, having promise of the life which now is, and of that which is to come." As the business of sheep-breeding is mainly in the hands of foreign residents, all that has been said respecting personal habits, and social life and customs, refers almost exclusively to that class of the Pampa population. "*Los hijos del pais,*" the children of the country, may be considered in connexion with another subject. Having been requested to say something with regard to the general climate and productions of the Pampa country, the remainder of the space allowed for this article must be devoted to those two subjects. Their relation to sheep farming, the principal topic in hand, will become sufficiently obvious in the sequel.

GENERAL CLIMATE AND PRODUCTIONS.

All periods of the year, and all ailments and infirmities of human flesh considered, there is, perhaps, no better climate for man than that of the South American Pampas. The heat is seldom oppressive, and the lowest temperature of the brief winter sends only a slight chill along the veins. There is, however, one noteworthy exception. The north wind, bearing in its breath exhalations from the immense water-sheds of the Andes, and heated in a good degree by the fires of the tropics, imposes upon delicate nerves a heavy weight of most disagreeable and annoying sensations. Such is the effect of this wind upon persons whose nervous system is peculiarly susceptible, that in the old Spanish courts some allowance was made for a criminal who had committed a crime during its prevalence. Many persons can by the state of their nerves distinguish whether the wind is from the north as soon as they open their eyes in the morning. The peculiar sensation it produces is much like that which a man experiences who encounters a provocation with an empty stomach and in the midst of the attacking forces of an influenza. But, fortunately for delicate women and nervous men, this is not a prevailing wind of the climate. Seldom does it last more than forty-eight hours at a time, when, chopping round to west or southwest, comes breathing so much freshness and coolness as to invigorate both body and mind to their highest pitch of comfort and capability of exertion; or to the southeast, when it usually brings rain, which, in that climate,

is the harbinger of refreshment to all weary spirits, to all languishing invalids, and to all drooping plants and flowers. In the cities and towns there are many sick people, as there are in all the towns and cities of this mundane sphere, and as there would be in paradise itself if in that happy clime and country the inhabitants were to keep late hours, go to packed concerts in gossamer, and thence suddenly out into the chilly, damp air of night, and frequent fashionable entertainments, at which rich suppers are given, long after midnight, and the dance is protracted into the dawn of morning. No climate would be proof against such waste of time and abuse of the best gifts of Heaven. But people do not live after any such fashion on the southern plains; consequently, there is not the shadow of a doctor to be seen, nor a drug-shop anywhere to be found. Doctors' bills, therefore, which in towns and cities frequently demand so large a portion of the laborer's earnings, form no part of his expenses there.

The one panacea of the merchant sea-service is known to be salts. If a sailor contracts a fever the captain prescribes salts, and if he breaks his legs the prescription is just the same. So it is on the Pampas. Medical treatment there is equally simple. Mutton-tallow is the cure-all. The shepherd kindles his fire with it in the morning, and dresses a sore or soothes a rheumatic with it at night. The health of the Pampa life is one of its most attractive features. Many impaired constitutions have there been restored, and to good fortune has been added "length of days."

In regard to productions in general, it may be said that soil and climate are alike favorable. In the northern sections of the great Pampa range, rice, sugar, cotton, and tobacco might be grown, as indeed might all the products of intertropical climes. In the middle and southern sections, embracing the States of Cordoba, Santa Fé, Mendoza, Corientes, Entre Rios, and Buenos Ayres, wheat and Indian corn might be produced, and are in comparatively small quantities. But, taking one year with another, the rains necessary to the perfection and abundance of these crops are so uncertain that the climate cannot be said to be favorable to their production.

With few exceptions, all the fruits of all the climes of the globe might be cultivated with success. The *apple* is one of the exceptions. It grows healthfully, and attains to a fine size, but is coarse, juiceless, and destitute of flavor. But it is peculiarly the land of the pear, peach, plum, nectarine, apricot, orange, fig, and the vine. Very little fruit, however, is cultivated. The native custom from the beginning has been to pay no more attention than could be avoided to any product that requires care or labor. Fruit is to be found generally on the estates owned by foreign residents, but seldom elsewhere. Hence, while it is the land of the orange, and orange groves might add their charms to the monotonous landscape, that fruit, so delicious in all continuously warm climates, is by no means abundant, and a single orange in the market of Buenos Ayres or Montevideo frequently costs as much as it would at the stand in New York or Washington. The orange is principally cultivated on the banks of the Parana and Paraguay rivers. The fruit is plucked before it has fully ripened, and is brought down to market in small vessels. This sufficiently accounts both for the imperfection of its qualities and the high prices at which it is sold. To be enjoyed in its perfection, the orange should be allowed to hang until it is ready to drop from its stem. In this condition it is to be found occasionally in small groves on the outskirts of the Pampa towns, and it is then a totally different thing from any product bearing its name that has travelled far either by land or sea. The vine has not been cultivated to any considerable extent east of the mountains, except in the provinces of Mendoza and San Juan. These provinces lie on the western verge of the Pampas, and directly at the foot of the great mountain chain. The climate is so dry that they are almost entirely dependent upon irrigation for their fertility. This mode of fertilization is facilitated by the rivers Mendoza, Desaguadero, and Tunuyan, which flow

down from the adjacent heights of the Cordilleras. The quantity of land thus watered is estimated at many thousand square leagues; and so rich and fertile is it rendered by the system of culture as to yield frequently more than a hundred-fold. The people are mostly descendants of families originally sent from the Azores by the Portuguese government to colonize Colonio del Sacramento, on the river Plate. At an early period of their settlement in their new home they introduced the culture of the grape, and, to a limited extent, the manufacture of wine. The two provinces probably export annually, through the mountains into Chili, and across the plains to Cordoba, Santa Fé, Buenos Ayres, a quantity varying from seven hundred to one thousand pipes. This is but an insignificant trade, and yet it is nearly, after home consumption, the total result of grape culture east of the mountains. The other provinces would be admirably adapted to the cultivation of the vine, but, as we shall see hereafter, their people find a more profitable and less laborious occupation. On the west side of the Andes, in the same latitude, the people of Chili cultivate the grape extensively, and produce wine for exportation in large quantities.

HORTICULTURE.

Excepting its western border, lying along the eastern slopes of the Andes, the whole Pampa country is admirably adapted to the growth of all the products of horticulture. Two crops of the potato are obtained yearly. The quality, however, neither of the sweet nor the Irish, can be regarded as equal to that of many other countries. But almost every other vegetable known to the gardener of the most favored climes may be produced there to any extent and of the most superior quality. The whole cabbage family flourishes exceedingly, especially that branch of it known as the cauliflower. The ripe head of this plant is of almost snowy whiteness, and when well cooked and dressed is one of the most esteemed of all vegetable delicacies. All varieties of the pea may be obtained in successive crops all the year round. But of all products of the garden, the *onion* of that soil and climate, in the writer's judgment, deserves the palm. In our own country it is one of the most unpopular of all edible roots; and it must be confessed that there are some serious grounds for its unpopularity as it is found in this latitude. But the onion of the Pampas is a highly cultivated and improved variety. It is neither, in its raw estate, so fiery in its taste nor so disagreeable in its odor. Its dimensions are frequently equal to those of the bottom of an ordinary saucer, its color is usually pure white, and either raw or cooked it is justly held in high esteem. The writer has a fancy that the Pampa onion must have descended from an old Spanish root, and that from an Arabic, and that from a Hebrew, and that from the original Egyptian leek; and if the original were equal to this very remote descendant, he does not wonder that the Israelites cherished such pleasing recollections of it in the wilderness, especially if they had been accustomed to taking it on the banks of the Nile, boiled, and dressed with salt, pepper, and cream. The Spanish-American, as is well known, is descended from a garlic-eating race, yet his onion, so incomparable when compared with the growth of other lands, is not his chief favorite. That vegetable which takes precedence of all others in the estimation of a genuine native of the plains is, in his own language, the "*sapallo,*" a species of the pumpkin. At first the stranger is not a little puzzled to find a reason for this singular preference. It cannot be based upon the inherent superiority of the thing itself; it has less of sugar, and less of the other properties of nourishment, than many other vegetables. Nor can the native preference depend upon any peculiarity in the mode of cooking his favorite. If the cooking had anything to do with the superiority claimed for it, no Yankee could be long in finding out the native's reason. He would remember "thanksgiving day." A vision would rise up before his mind, in which there would be the

roasted turkey flanked with *pumpkin pies*. The true reason of the native's preference is doubtless to be found in the hereditary disease of his climate. His favorite sapallo will grow like a gourd if a hole three inches deep be dug in the unploughed soil and the seed dropped in. It is, in reality, an insipid thing at best, and is only to be relished by a civilized man when taken full grown from the vine, and baked dry with meat, like a sweet potato; or, when taken young, deprived of its seed and pulp, filled with hashed meat, and baked quickly in a brisk oven. Any tract of land in that country, great or small, devoted to the cultivation of grains, fruits, and garden vegetables, is called in Spanish a "*chacra*," in contradistinction from a sheep or cattle farm, which, as before remarked, is called "*estancia*" throughout the southern continent, and in Mexico "*hacienda*." This species of cultivation is, especially in the vicinity of the cities and towns, almost entirely in the hands of foreigners. A few of the French immigrants invest their means in this way; some Spanish basques do the same; but by far the greater part of the farming and gardening is done by Italians. No foreign residents in the country are more industrious, nor do any more generally succeed in their undertakings. As horticulturists, especially, they display a great deal of taste and judgment. While attending market with their products they are invariably civil, obliging, and honest. The majority of them are from the "States of the church," and much as we have seen from the pens and heard from the tongues of laymen against the reign of the priests, it certainly speaks well for this peasant class of the Pope's subjects that they are sufficiently actuated by religious principle to abstain from the rudeness, lying, and overreaching that are so common in the market places of this world; and that as soon as by their industry and frugality they have acquired a modest independence, they, almost without exception, return to their native land to enjoy the fruit of their good fortune, and to die and be laid to rest among the loved scenes of their childhood.

But the most extensive, and at the same time successful, farmer in all that country is Mr. John Clark, a British subject. His example shows what may be accomplished in farming by tact, industry, economy, and perseverance. He began, in a small way, some thirty years ago, in the department Quilmes, about fifteen miles south of the city of Buenos Ayres. At first he cultivated garden vegetables exclusively, intended mainly for the supply of the foreign shipping in port. Afterwards, as he made additions to his original tract, he planted wood, corn, sowed grass for hay, divided his land into fields, enclosed it with hedges of the napandai, introduced sheep, opened a store, and finding ready market for his products, either in the city or on his own premises, his career was almost without obstruction, and to-day he is one of the richest men on this continent, south of the equator. One reason of his marked success is, that there was but little real competition in his particular department, and to this day the competition has not much increased. The field is fairly open to skill and enterprise, and many of our American farmers would equal, and even eclipse, the career of Mr. Clark. Perhaps no department of farm labor in that country would pay better than a good dairy. Butter that would be condemned in our markets brings frequently in the markets there one silver dollar per pound.

Fortunate in its climate, and rich in pasture and all the varied productions of horticulture, the whole of the middle and southern Pampa country is singularly destitute of woods and minerals. Historians inform us that the discoverers gave the name of "El Rio de la Plata" to the mighty stream which flows along the eastern margin of the plains, because they found silver near its mouth. If they did, it must have been in very small quantities, and their own was the one solitary instance of such good fortune. Since the further exploration and settlement of the country, neither silver nor any one of the other precious metals has ever been found on the banks of the river, not, at least, in such quantities as to attract the footsteps of the adventurer. The traveller may

explore districts of the Pampa territory, hundreds of miles in extent, and not find a stone big enough to kill a sparrow, nor a cart-load of gravel to sprinkle on a muddy sidewalk. On account of the universal absence of wood and stone, bricks are used in the construction of dwelling-houses and for all other works of private convenience or public utility. They are manufactured not from the clay, but from the surface soil, mixed with straw, or loose stable manure; are in size nearly three times as large as the ordinary American brick, and are burned in kilns, with weeds, thistles, dried manure from horse stables and cattle pens, and the decaying carcasses of dead animals. It has been related by some travellers, as an evidence of the inhumanity of the people, as well as of the country's extreme destitution of fuel, and the insignificant value of the native sheep, that flocks of that animal were, in former years, driven alive into the furnace, and burned for the purpose of giving hardness and color to the contents of the kiln. But it will be seen at once that this is a story made from the whole cloth. It is true that cruelty to the dumb animals, used for their convenience, is a general characteristic of the people. Yet any one who knows anything of the structure of a common brickkiln, knows that living sheep could not be driven into it for fuel, or, if such a thing could be done, it would still be so much easier to kill them first, that the barbarous and horrible act of consuming them alive could never form any part of the industrial practice of a people who often waste their money, but never their strength, in the performance of needless labors.

The only indigenous tree of the Buenos Ayrean Pampas, and those of other districts immediately adjacent north and south, is the *umbú*. Indeed, this solitary native can hardly be called a tree. It partakes rather of the nature of a giant poke weed; is so porous in its texture and so filled with sap as to be inconsumable when green, and when dry, an armful of it would be about equivalent to an ordinary bundle of top fodder. In crossing the plains, this tree is frequently the traveller's sole guide, and as it seldom grows in clumps, and one full grown very closely resembles the whole family of full-grown trees, it requires a practiced eye, somewhat like the Indian's in the forest and on the war path, to avoid confusion and the undescried roads. For this reason strangers seldom travel off the regular post-routes without a compass or a guide. So far as the experiment has been made, imported trees have been found to flourish exceedingly well, especially the maple, the poplar, and the pine. As a substitute for wood the people (when they have not planted trees, as will be described hereafter) are compelled to resort to the dried thistle and to a weed similar to (perhaps the same as) our stick-weed, called in Spanish *biznaga*, and to products of living, or the bones of dead, animals. Even the most moderate degree of civilization implies cooking, and a hungry man, who is not a downright savage, will manage somehow to find something with which to make the pot boil. The traveller takes his cup of smoking coffee—good coffee, too; no mere hot slop, tinged with brown—that was boiled over a fire made of cakes of cow or sheep manure, dried in the sun, and kindled with a few scraps of mutton-tallow, and eats as good bread as he need ever desire to taste, that was baked in an oven heated with the dried but still offensive carcass of some poor horse killed by overriding.

The country resident, who desires convenient and abundant fuel, plants the peach or paradise tree. The ground for this purpose is ploughed, then laid off in rows at right angles, and the young scions are planted about twenty feet apart each way. At the end of the third or fourth year the trees are cut down, bound in bundles, like corn, and stood on end to dry. The single root and stalk shoot quickly up in several stems, and these, the third or fourth year, are also cut down, and so on in succession. How long the root retains its vitality and productive power is a matter which the writer neglected to ascertain. The plantation is surrounded with a wire fence to prevent the herds of cattle from

browsing upon the tender trees, and the grove is denominated "El Monte," the wood, which Spanish appellation is universally adopted by foreign residents.

No one ever says in the parlor, but in the *sala;* nor in the yard, but in the *pateo;* nor will you be helped to the preserves or sweetmeats, but to the *dulce;* nor in Piety street, but in *calle Piedad;* nor in Independence square, but in *plaza Independencia;* nor a good voyage, at parting, but *buen viagé;* nor good-by, but *adios*—I commit you to God. These Spanish substitutes are used so constantly and universally that, in a few months, the supplanted English terms seem to the Englishman's owner like aliens from the commonwealth of English nouns, and strangers to the covenant of words that he had been incessantly repeating all his life.

The cultivation of wood is rapidly becoming a very important branch of business in all the most thickly settled portions of the Pampa country. Whether the practice was originally introduced by immigrants or natives, the writer cannot say. Until the arrival of foreigners, in considerable numbers, fires were not used except for cooking and other purposes of the kitchen, even by the most wealthy and stylish families. In the severest weather of winter, a little charcoal was ignited in a *brasero,* the gas consumed, and then the glowing coals were introduced into the parlor or bed-chamber in their primitive-looking foot-stove. The ladies, enveloped in their thickest shawls, and the children wrapped in their warmest clothing, would gather around the fire, drink *mâte,* (the Paraguayan tea,) and prattle and gossip away in mood of high contentment. But in all the best houses the *brasero* of former times is giving place to the open grate, for English soft coal, or the air-tight stove, for wooden fuel. Imported coals are so expensive that wood is generally preferred. With immigration, the demand for this continually increases, and the natives themselves, improved in their ideas of domestic comfort by the examples of foreign custom, contribute largely to the general consumption of fuel. The supply of wood for all that part of the continent to which this article mainly refers is to be derived from two sources—the planted *monte* and the islands of the Parana river. On these islands the *Algaroba* and the *Espinella* tree, though not large, are found in abundance. The texture of their wood somewhat resembles our black oak, but in substance it is as heavy as our beech. This wood is worth about fifteen silver dollars per cord in the market of Buenos Ayres. During the summer months many Italian immigrants employ themselves in the islands cutting and preparing wood for market. The islands themselves are regarded as government property. But no particular jurisdiction has ever been exercised over them, as they have never been permanently inhabited, nor any account taken of their productions. The wood-chopper plies his axe and loads his vessel without tax upon his cargo or hindrance of any kind to his labors. And, indeed, it may be regarded as one of the mysteries that appear in the choice which men make as to their place of abode and the character of their employment, that any one should ever for a time accept a *fee simple* of any one of these islands, with a title to all its productions. And if the woodman who makes the choice can also make good his ground against the *mosquitoes,* he might be safely depended on to mount into the breach of another Malakoff, or to stand in the front line when indomitable Grant gives the signal for battle. The wood that is thus procured could not be conveyed beyond the coast towns and cities; transportation inland by steam is unknown, (with the exception of the railway from Buenos Ayres to Mooen, a few miles long,) and the expense of carriage would be so great as to render impracticable any attempt to furnish supplies to the interior. The *estancieros* and *chacreros* (cattle-breeders and horticulturists) must, therefore, obtain their supplies of wood from the planted *monte.* And their demands, in this particular, are not inconsiderable. All their sheep and cattle pens, all the timber used for fencing gardens or wood plantations, and all their fuel for domestic use, (if they wish

to be really and uniformly comfortable,) must be obtained from planted trees. This being the case, many of the large sheep-farmers have planted extensive *montes* on their *estancias,* and the trade in the Paradise and the peach tree is more important and valuable than that in wheat and corn.

From this imperfect sketch of the country's general productions it will be seen that its herds and flocks must ever be regarded as its principal source of wealth, and that to this, almost entirely, its people must look for the means of advancement in a career of true power and civilization. Not only is the climate too uncertain in its supplies of rain for wheat, but the plains northward of the 30th parallel of south latitude are infested with the ancient plague of *locusts* and the modern plague of *biscachas.* At this season, (December,) says a recent traveller, speaking of the province of Cordoba, crops are liable to be destroyed by locusts, which come out of the woods to the north, and literally cover the earth. When young, these pests do not fly, but crawl and jump like grasshoppers; afterwards they take wing and migrate in clouds, destroying all vegetation wherever they halt for food. We rode through a large extent of country, in which they covered the shrubs and trees, presenting the appearance of bees. When the locusts first make their appearance, the people turn out and endeavor, by waving shawls and other means, to turn them aside from their fields, so that they may pass on without halting. Another annoyance to which these people (the Cordobase) are subject is from the *biscachas.* Occasionally a great part of the night is spent in chasing them with dogs. A still greater hardship is the want of water. In some parts the well-water is brackish, while the fall of rain is frequently insufficient for the production of a fruitful harvest. The grasses on which feed the flocks of sheep and herds of horned cattle are not disturbed either by the *biscachas* or the clouds of these winged destroyers. Besides this, neither the cultivation of grains nor the preparation of timber for market could ever engage the attention of those countries beyond the supply of domestic necessities. Some twelve years ago, Colonel Graham, United States consul for the port of Buenos Ayres, was charged with a special commission from his government, and, in obedience to instructions, visited the interior countries of the southern continent bordering on the Parana and Paraguay rivers. In a report which he made to his government embodying the results of his observations in Paraguay, he says: "Paraguay possesses, in many parts, a fertile and productive territory; and were its resources developed, and encouragement given to the industry of its inhabitants, it might become a comparatively wealthy part of South America, *but it could never support an active trade excepting with the adjoining states.* Yerba, the tea of Paraguay, its chief product, is only consumed in South America; its fine woods would not bear the expense of transport to Europe; its sugar, tobacco, cotton, and rice, on account of the distance which they would have to be conveyed from the interior, even were the Parana open, (that river has since been opened to the navigation of all nations,) could never enter into competition with those of Brazil and the United States; its chief market, therefore, would always be, as heretofore, the countries watered by the Parana and the Salado. The consumption of foreign manufactured goods is now, and must always continue to be, very inconsiderable; at present, the people purchase some articles of foreign hardware, and cotton goods of ordinary quality, but the climate is so mild, and the manners of the people so simple, that the consumption is very limited. If the Parana were declared open to all nations the United States could not carry on any direct intercourse with Paraguay under its own flag. The vessels adapted for crossing the ocean would not go up the Parana, [the Colonel is mistaken in this,] and merchandise would have to be re-embarked at the mouth of the river in craft suitable to its navigation, and owned by parties resident in the country." Since the report, from which this extract is taken, was written, the Parana and its tributaries have, by commercial treat-

ies with Brazil and the United States, been thrown open to the trade of the world, and carefully surveyed and mapped by an expedition sent out under the direction of our Secretary of the Navy. That survey demonstrates that vessels drawing twelve feet may ascend the Parana and Paraguay (tributaries of La Plata) to a distance of two thousand miles from the ocean. Yet the writer, who visited the same countries on the track of Colonel Graham, is prepared to confirm all that he has said as to the utter impracticability (in the present condition of those countries) of exporting with profit the general products of the interior portions of the southern continent to the markets of Europe or of the United States, or of introducing into those countries the manufactured goods of Boston or Liverpool with compensation to the merchant. The whole world is beginning to move very rapidly. What changes a century or half a century may produce in the southern continent, and how near the countries embraced within and lying on the borders of the Pampas may be brought to the other ends of the earth, none can now foretell. No section of this globe can be better adapted to the construction of a general system of railways, and it may be that such a system is to be one of the marked features of a great future reserved for that country, and that, with an augmented and enterprising population, its varied productions may find their way to the sea-coast, and a profitable transportation thence to the markets of other and far-distant climes.

Be this as it may, wool must ever form the grand staple of the great southern plains. For the present, sheep-farming, with the breeding of horned cattle, furnish the sole trade of any value in that vast portion of our continent, and this great department of agriculture must receive there constantly increasing attention and improvement. The one great drawback upon sheep-farming and every other branch of business in that country is the frequency of political revolutions by means of civil war. So far as statesmanship is concerned, but little could be said that would be complimentary to the South American Spaniard. A long and careful education in the science of government, founded upon some natural aptitude for the exercise of its prerogatives, is necessary to constitute the citizen a true statesman. No such training had been given to any class of the South Americans prior to the period of their independence. During the long centuries through which they preserved their allegiance to the Spanish crown they were treated very much as grown-up children. Since their independence they have been so much of their time involved in domestic strife and bloodshed that they have had but little leisure, and perhaps less inclination, for making any attempt to found schools of politics or the turning of their attention seriously to subjects of administrative reform. As has been intimated, statesmen do not spring out of chaos. Great soldiers and great despots do, but liberal statesmen, capable of founding and wisely administering a free government, never. The grant of the great charter is the act to which may be fairly traced the liberties of this country; and Washington, Jefferson, Jackson, Webster, Clay, Lincoln, Seward, Chase, and Butler, may be regarded as the legitimate descendants of those proud barons who wrung the great charter from the reluctant hand of the humbled King John. It may be affirmed, with some degree of assurance, that the political state of all the South American countries now tends towards a gradual and permanent settlement. Contrary to the general opinion in this country, the people themselves have never been ambitious, aspiring, turbulent, and difficult to govern. The chief defect has been want of political ambition, and their gravest fault, in practice, the little interest they have taken in political affairs. The masses care nothing about voting, care not who are candidates nor who governs them, provided they have plenty of beef to eat, and plenty of time to spend in gambling and racing horses. All their political revolutions that have been bloodless, and all their wars that have been attended with horrible atrocities and great loss of life,

have been the work of a few men. The general war for independence left in those countries numerous chiefs, who were too proud to work and too poor to live in idleness. They have been always among the chief promoters of revolutions. This class of turbulent spirits is now almost entirely extinct, and a younger class of revolutionists, bred by their example, is rapidly losing its influence for mischief, and in a few years, it is to be hoped, will have disappeared forever in the mass of quiet, order-loving and law-abiding citizens. Before the last sunset of the present century shall have gilded their snow-capped mountain peaks, lighted up their valleys, and shed its mellow radiance over their grassy plains, it will have been demonstrated whether, as a people, they are capable of reducing to practice the ever-glorious but ever-difficult theory of self-government. God grant them success, and speed them safely in a bright career of freedom, regulated by law and sanctified by religion, to a glorious destiny in centuries to come!

"TEXEL" OR "MOUTON FLANDRIN" SHEEP.

BY WINTHROP W. CHENERY, BELMONT, MASS.

THE production of long, combing or lustrous wool has been for many years fostered by the English government and manufacturers, and especially requires encouraging in this country, where the demand is so great and the supply so scanty. The manufacture and the use of woollens made from coarse wools, as distinguishable from merinos or fine wools, has increased immensely within a few years.

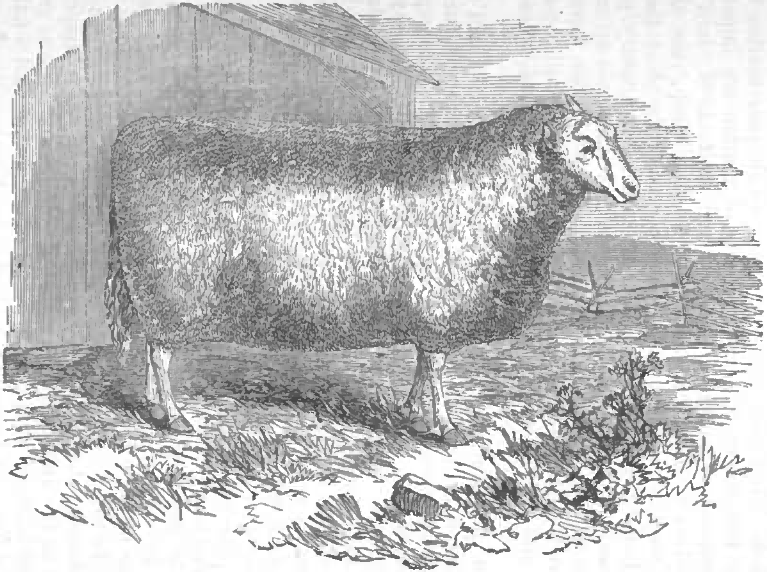
Carpets, bockings, baizes, are more commonly used; so are damasks, moreens, and goods of that description, in upholstery; for men's wear, tweeds and fancy cassimeres of coarse wool have, in ordinary use, superseded broadcloths and fine cassimeres; while, for women's use, crapes, alpacas, merinos, and worsted goods of every description are fashionable, and, of course, much worn.

Indeed, every dry-goods establishment gives sufficient and positive proof of this increasing change in the great variety of fabrics in constant demand made from wool of this description.

A comparatively small amount of this wool is grown in this country as yet, our manufacturers depending mostly on foreign countries. Almost all the English wool is made into worsted goods; and, while they import largely, they find it difficult to obtain full supplies.

In a discussion before the London Farmers' Club a year ago a large manufacturer observed that the demand for this wool had almost exceeded the supply during the past few years; and, from the gradually increasing price of this wool, and from the weight of fleece produced, it was a matter of great importance to the farmer to consider whether it was not for his interest to try and increase the quantity of this wool, and whether it may not be the most profitable article which he can grow on his farm; and the question for him is, how can we best supply the rising demand for this class of wool?

He says: "To the agriculturists I dare not offer a word touching the encouragement to be given to this or that kind of sheep. I can only convey to them, as a worsted spinner and manufacturer, a knowledge of the want of this particular kind of wool at the present day. To them I also point out the fact that our woollen trade has greatly increased, and would be still more largely increased had we sufficient of the raw material. A circular issued by the Chamber of



TEXEL, OR MOUTON FLANDRIN EWE.

Imported and owned by Winthrop W. Chenery, Belmont, Mass.

Commerce of Bradford and the woollen districts says the very high price of combing wool has led to the consideration whether it is not possible to encourage its growth, the high price being attributable to the consumption of this kind of wool gaining upon its growth. The Chamber of Commerce is of the opinion that no large additional supply can be obtained from the home growers, and points out places whence supplies might be obtained, and invites the organization of societies to disseminate among the inhabitants of such countries the information on management always at command.

"Again they say, the wool required should have a staple of from four to seven inches in length, of uniform quality throughout its whole length, and bright and lustrous in appearance. In addressing foreign powers they point to the fact that the flocks should be pastured as much as possible upon succulent grasses similar to those grown in Great Britain, the object being to obtain a bright lustrous wool." Mr. Cobden said: "The large quantity of wool which is imported from India is a very useful wool for blanket and carpet manufacture, but it does not compete with our long English wools; the same may be said of our Australian colonies, the whole coming from there being adapted for clothing, except the longer staples, which compete with our Down and German wools. There are hopes that at some time we may obtain from New Zealand a long staple wool, but at present that wool lacks the lustre which is a distinguishing feature of our long wools. From Canada we have received a small supply at uncertain intervals of a wool very much resembling our Leicester wool; but this wool is much depreciated in value for the want of cleared enclosures for sheep to graze in. This want causes the wool to have a good deal of burr or seed gathered by the wanderers, which is very troublesome to the manufacturer, and it will be a long time before Canada will be able to supply us with such wool."

The long wools were principally classed under the heads of Lincolns, Leicesters, New Oxford, Cotswold, Romney Marsh, Teeswater, and Kents, and we find the Texel sheep equal to any.

The old Lincoln sheep produced a long wool, making a fabric of lustrous appearance, almost resembling the Mohair or Angola goat; the Romney Marsh much the same; the Lincoln is finer, but not so lustrous; the Cotswold is a long staple and of a harsher character, used for combing purposes; the Down is of a shorter staple and used for worsteds.

Mr. Unwin observed that there was a greater demand for long wool and a wider scope for the extension of the growth of wool and breeding sheep than there was in any other department of agricultural enterprise or production, and he thought it the duty and interest of the British farmer to increase the production of this article to the fullest extent. The augmented value of lustrous wool was owing to the introduction of an entirely new branch of manufacture—the alpaca cloths—a most beautiful fabric. The extensive use of alpaca generally led to an increased demand for Lincoln wool for the purpose of mixing with alpaca and manufacturing these beautiful fabrics.

The result of this great demand for Lincoln wool has been to change the relative positions which the long and short wools formerly held, so that at the present time, in Bradford, the great centre of the coarse wool manufacture, South Down wool is selling at 1*s.* 8*d.*, and Lincoln fleece at 1*s.* 11*d.*

The home growth of England is estimated at about 175,000,000 pounds, all of which is long, or combing wool, or suitable for worsted manufacture.

All the foregoing remarks on the importance of producing more long wool apply with increased force to this country, where we consume so much and produce so little of that class.

For the last two or three years the long combing wools, called Canada, have brought the highest price in market on account of the scarcity of that class.

An examination of our imports will show that of some sixty millions of

woollen goods, about forty millions were manufactured of the longer worsted wool.

How important it is, then, that our farmers should pay more attention to raising sheep that will produce this class of wool so much desired, and also a good quantity of meat for the shambles.

"A nimble sixpence" is the maxim of trade and production in this country. A coarse wool, at the age of one year, may readily attain the weight of one hundred pounds; it may grow in that time eight pounds of wool. This wool would not waste more than twenty to twenty-five per cent. in scouring. A merino might be two years in getting a weight of fifty pounds, and produce ten pounds of wool, which would lose one-half in scouring. So the Cotswold would produce more real wool, (bringing at present prices quite as much money,) and twice as much flesh, in one year, as the merino did in two. As the uses of sheep comprise mutton-producing as well as wool-growing, this would be an economy of time, and a guarantee of "quick returns," quite in accordance with American activity and impatience of delay.

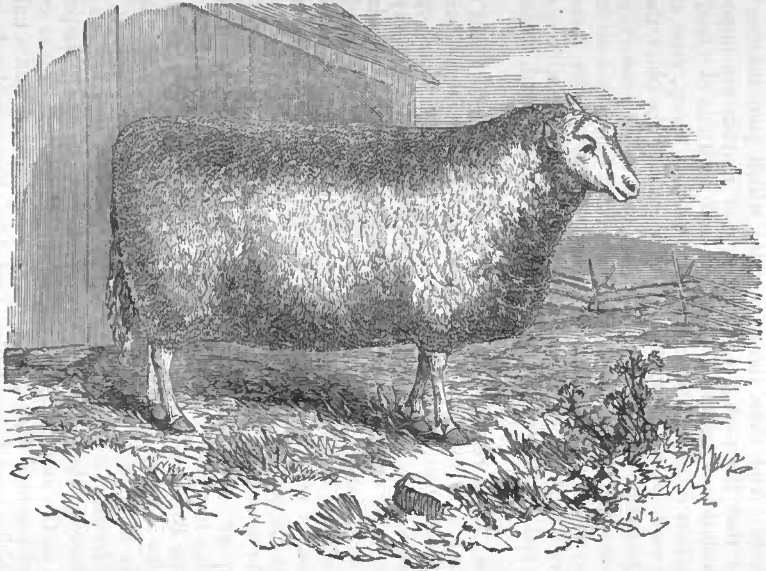
That this supposition is by no means unfair to the merinos is shown by a report of a committee of the New York Woolgrowers' Association, upon the award of Mr. Moore's premium "for the fleece of one year's growth or thereabouts, which, on being cleansed, shall be found to give the greatest weight of wool, in proportion to its time of growth and to the live weight of the animal."

There were fourteen merinos and, accidentally perhaps, a Cotswold ewe. The age of the latter was one year and twenty days. She weighed 99.5 pounds, her fleece 8.9 pounds, 7.31 pounds of scoured wool, a shrinkage of only 18 per cent., making her percentage of scoured wool to weight of animal 7, and to the weight of fleece 8.2.

The merino that took the prize was a ewe two years old, weighing 49 pounds, with a fleece of 9.85 pounds unwashed, and only 4.75 when scoured. While her percentage of fleece to live weight was 20, and that of the Cotswold only 8, their actual percentages of scoured wool to live weight were as 9.6 to 7. The Cotswold actually produced in one year 7.06 pounds, the merino 4.72 pounds. The report gives the Cotswold a middle place, with seven merinos on the list above her and seven below, as to the quantity of wool produced by one pound of animal in a year.

But the calculation of the committee embraces a fallacy, which vitiates the result, and actually places the prize animal below the Cotswold ewe. They assume the weight of the latter to be 99.5 pounds during the entire year, when she was a lamb of twenty days old as well as upon the day of shearing. Now, the fair method of calculation, and that which Mr. Lawes adopted in his well-known experiments, is to take the mean weight of the animal at the beginning and at the end of the experiment; for, if an animal consumes food in proportion to live weight, and its capacity for growing wool is affected by the same consideration, how unfair to estimate the cost of food or the amount of wool daily produced, the same in the case of a lamb of half a dozen pounds as in that of a sheep of one hundred pounds. It will be an estimate favorable to the merino to assume its weight at one year only 31 pounds, making its mean weight for the time of the experiment 40 pounds. The mean weight of the Cotswold might be 55 pounds. The merino having of scoured wool 4.75 pounds, the Cotswold 7.31 pounds, the quantity produced by each pound of the live weight would be, the merino .11875, the Cotswold .13290. In other words, one hundred weight of animal would produce in one case but 11 pounds 14 ounces of cleaned wool; in the other, (Cotswold,) 13 pounds 4 ounces.

So the Cotswold not only yielded more actual wool to the live weight, but about twice as much flesh in one year as the merino did in two. The New York committee were asked to decide only upon the wool-producing value of



TEXEL, OR MOUTON FLANDRIN EWE.

Imported and owned by Winthrop W. Chenery, Belmont, Mass.

the sheep, and properly concluded that "*for the mere purpose of wool-raising very large sheep are not desirable.*" They might have added, that, for the purpose of *profit*, either by wool or mutton, *very old sheep are not desirable*, and that the more thrifty the animal, the more rapid the growth, and the better the wool.

The short-horn cattle, maturing for the shambles in two years, are the only beeves desired by the cattle-feeders of this country. The Leicester sheep at one time monopolized the feeding grounds of England by reason of their early maturity. The same principle will eventually, and soon, reduce the numbers of our sheep, which require three or four years to mature. It will also compel the killing off of sheep that have attained their growth, and cannot add another pound to their flesh. And, then, the poor price which poor mutton will command will prove that the quality and quantity of mutton are important elements in the calculation of profits. With hay and all kinds of "feed" at high prices, as in populous districts, the economy of keeping sheep, year after year, simply for their wool, which becomes poorer in quality the older they get, is not manifest. Quite thirty millions of sheep are now in the country, producing so large an increase yearly that the destruction of the old, if not an imperative necessity, will prove a practical certainty; and, as the number increases, the tendency to active slaughtering will become more marked. Shall the slaughter affect the young and thrifty, with bright, soft wool, or the aged, whose wool is deteriorating?

Another reason for increased attention to long wools is the fact that new fabrics are introduced in great variety, especially for the various garments of ladies requiring soft or lustrous wools, and are becoming daily more popular and more widely disseminated. This state of things has caused a scarcity of long wools and given them an advantage in price over the most popular of the merino wools of this country of fifteen to twenty per cent. In England this change of place of long and short wools, by which the long wool has exceeded the short in value as much as that formerly led all others, is thus referred to in the *Mark Lane Express:*

"The causes for so strange an alteration in the wool trade are various, but may be traced to the introduction of the llama wool from Peru. The length and fineness of this material enabled the manufacturer to make a kind of fabric entirely new to the British market, namely, those light gossamer stuffs so much prized and worn by our fair countrywomen. The success of this material set the manufacturers to work to attempt imitations of it from the long wools of British growth. In this they succeeded, especially since the invention of combing wool by machinery, about fourteen years since, which greatly improved the operation as well as the uniformity of the material upon which it was employed. By the use of this machine wool can now be combed of two and a half inches in length, but it is the long Lincolnshire, Yorkshire, Romney Marsh, and Cotswold that have so much increased in value since the introduction of the llama and alpaca wool. The facility for perfecting these wools for the purpose of making imitations of llama fabrics is one of the causes of the advance, for the enormous demand for such fabrics for foreign countries, with the supply limited to the growth of the United Kingdom, has rendered this far more scarce than the short wool of which the amount from our colonies of Australia and New Zealand is annually increasing." These remarks will apply with equal force to the Texel sheep.

There is, in addition, a strong pecuniary inducement to use these wools, notwithstanding their price. They contain little oil or yolk. In scouring, the loss is rarely twenty-five per cent., and often less than twenty. The loss in the merino is forty per cent. and upwards, according as it is "improved;" the fleeces of prize rams often reaching seventy per cent. of waste. Excluding

these, and taking the most desirable Ohio grades, a comparison will show the superior economy of long wool to the manufacturer. The manufacturer pays seventy cents per pound, at present prices, and loses fifty per cent. in scouring, making the cost of the clean wool one dollar and forty cents. He buys Canada wool at eighty cents, and loses twenty per cent., leaving the cost of cleaned wool just one dollar per pound. Is it a wonder that manufacturers will use all the long wool they can, when it will make forty per cent. more cloth with the same money? By *Canada wools* the manufacturer simply means Cotswold' Leicester, Southdown, and their grades, most of which come from Canada, where few other sheep are kept. The manufacturers are getting awake to the extravagance of buying sixty or seventy pounds of grease and dirt in order to get thirty or forty pounds of wool. If farmers are equally wakeful, they will aim to produce the heaviest *cleansed* fleeces, and will be prepared to profit against the discriminations which manufacturers are preparing to make, and are even now, to some extent, making. And if, by selection of a location with a moist atmosphere, and an abundance of succulent food, the glossy, lustrous wool, like that of the Lincoln and Romney Marsh, in England, could be obtained in this country, for imitations of alpaca, it might, perhaps, prove the most profitable enterprise in wool-growing known in this country. The experiment is well worth a trial. The changeable atmosphere of this country might militate against the experiment, but there may be locations, near the lakes, or upon the cool, moist, rich glades of the Alleghanian plateaus, where it would prove highly successful and very profitable. Such wool would be worth more than merino, not only per pound or fleece, but also in proportion to the live weight of the animal, while the mutton would be far superior in price as well as quantity.

There is a want which might be met by enlarged operations in rearing long-wool flocks. Our markets, with few exceptions, are miserably supplied with large fat lambs. Nor can it be otherwise with our present flocks. Merino lambs will never satisfy the demand of enlightened eaters. Six pounds to the quarter, of lean, blue meat, at twelve weeks old, will never afford satisfaction to marketers, when fine fat quarters of twice that weight are obtainable. Nor will it pay the farmer to sell such lambs when those of double value could be produced in the same time at a little more expense.

As with lamb, so with mutton. Occasionally good fat mutton may be found in the butcher's stall; but where one is seen, a dozen lean and bony carcasses are exhibited. The buyer, who loves juicy chops or a fine leg of mutton, is compelled to pass by and procure a dinner from a loin of beef, of which there is usually an abundance of unexceptionable quality. Then there are others, who profess to dislike mutton, and always avoid it, simply because they have tried the poor, tough, unpalatable meat sold under that name. The ranks of mutton-eaters would soon be largely recruited from this class, if sheep of the proper breeds could be obtained by butchers. Mutton might then become, as it is in England, the best-liked and most generally used variety of meat. The prices of mutton in the London markets, at the present writing, average as follows, at wholesale:

Poor quality, per lb	13 cents.
Second quality per lb	15 "
Prime long-wool breeds, per lb	17 "
Prime Southdowns, per lb	18 "
Lambs, per lb	21 "

The retail price of lambs, the best pieces, is thirty-five to thirty-six cents, in gold—quite equal to the highest rates in the dearest markets of this country during the last year of the war, in the currency of the United States. This may be taken as an indication that prices of good lamb and mutton, which have

long been increasing in this country as well as in England, will be very sure to rule high here for many years to come.

Those, therefore, who commence with judgment and energy the production of really superior mutton, or early lambs, will reap an abundant harvest of profit; and the earlier the start, the quicker the reward. That it will engage the attention of enterprising farmers, and meet their just expectations, there is no room for doubt. With what particular breed of mutton-sheep, whether Downs, Texels, Cotswolds, or combinations of any of them, the best success may be attained, is a subject for more particular consideration—for experiment under different circumstances, in different latitudes, altitudes, and with different grasses.

It is thought that the price of meats will decline disastrously at the close of the war, and the public dissatisfaction, if such expectations should fail of realization, will be universal. It should be remembered that the war has somewhat reduced our meat supply. The war may soon be over, when a pastoral life will be quite too tame for soldiers, and the waste of meats cannot soon be repaired. Many of the soldiers are machinists and artisans. Thousands of them will repair to the mines of the Rocky mountains; not a few to prospect for petroleum; and many will seek in trade and speculation in cities the excitement which they crave. Most of them are efficient consumers of meats; very few will be producers. Then our shores are swarming, and for years will swarm as never before, with foreign immigrants, hungry for meat, however poverty has stinted their former supply. All these mouths, and those of millions of now unborn children, are to be supplied in the years of the immediate future. With what shall we feed them? Not with pork, becoming vastly dearer with the increased price of corn; not altogether with beef, while there is such a demand for wool, and just precisely the kind of wool produced by mutton sheep. We must have mutton; and sensible men, with money in their pockets, will pay prices that must *command* good mutton and render its production highly profitable. Conditions now exist favoring adequate remuneration in this branch of husbandry that have never before been brought together in so potent a combination. There is an opportunity to achieve a fame and a success in this direction, in a field as yet almost entirely new, that should engage the effort and ambition of our young and enterprising stock-breeders; and there is little doubt that it will be promptly and successfully occupied.

Early in the seventeenth century the long-legged African or Guinea sheep were introduced into Europe by the Dutch, and distributed among the islands near the Texel, and in Groningen and Friesland, where they were crossed with the common sheep of the country, producing the animal known there at the present time as the "*Texel*" or "*Mouton Flandrin*" breed of sheep.

At the period of the introduction of these sheep into Europe, some highly exaggerated accounts were given of them, says Youatt, by the writers of that time.

Corneille states that "they produced lambs twice in the year, and usually three lambs at a time, sometimes four and five, and occasionally, although rarely, seven at one yeaning." This, continues Youatt, is quite incredible, and Corneille himself acknowledges that it was "only on their first arrival from the east that they were thus prolific, but they were, and still are, justly valued for their size, beauty of form, and abundant produce of long and fine wool, milk, and lambs."

Wilson, in describing these sheep, says the ewe is remarkable for always producing several lambs every year, and whose wool, while possessing a certain degree of fineness, is of great length, and Youatt, writing in 1837, speaks of them as being of large size, measuring sometimes two feet nine inches in height, and having considerable resemblance to the British or Irish long-woolled breeds.

They are, he says, more prolific than any English breeds, and produce long fine wool, which can be appropriated to valuable purposes, and milk which is valuable and is used by the Dutch and Flemings in the manufacture of considerable quantities of cheese of good quality.

An anonymous French writer, in a work published by royal authority in 1763- in describing this breed of sheep, says that "it unites in itself the perfections be, longing to every other breed without their defects; its walk is firm, its deportment noble, its form well proportioned in all its parts, announcing a good constitution and a healthy temperament, and exempt from the maladies so common to other breeds. The length of its wool is proportioned to its height, and it does not disfigure the animal as in the English sheep, whose fleece is a burdensome weight, especially at the return of spring. The Flemish (Texel) sheep carries nothing about him that in the least detracts from his beauty. His wool is white without spot—it is of a dazzling whiteness; he is contented everywhere—everywhere he becomes a citizen of the place he inhabits."

This may have been, and doubtless was, extravagant praise, yet the Texel sheep of the present time are a remarkably beautiful, compact, hardy, and prolific race of animals, possessing quiet and contented dispositions, readily accommodating themselves to change of soil and climate, producing heavy fleeces of long and tolerably fine wool, mutton of superior quality, and lambs which, at four months of age, attain a weight of from seventy to eighty pounds.

The ewes generally produce twins, and occasionally breed twice in one season; both sexes are without horns.

The Texel sheep have not been extensively introduced into the United States, American sheep-breeders generally preferring to import the well-known and well-tried British breeds of mutton sheep. It has, however, been stated that the late Colonel Jaques, of the Ten Hills farm, of Somerville, Massachusetts, imported sheep from the Netherlands in 1823, and the "Massachusetts Agricultural Repository and Journal" records the importation of some sheep from the same source by the late Colonel Thomas H. Perkins, of Brookline, Massachusetts, in 1824. They were called the long woolled sheep of the Netherlands It is not known whether these sheep were of the true Texel breed, nor is it probable that pure-blood animals descended from that importation are now in existence.

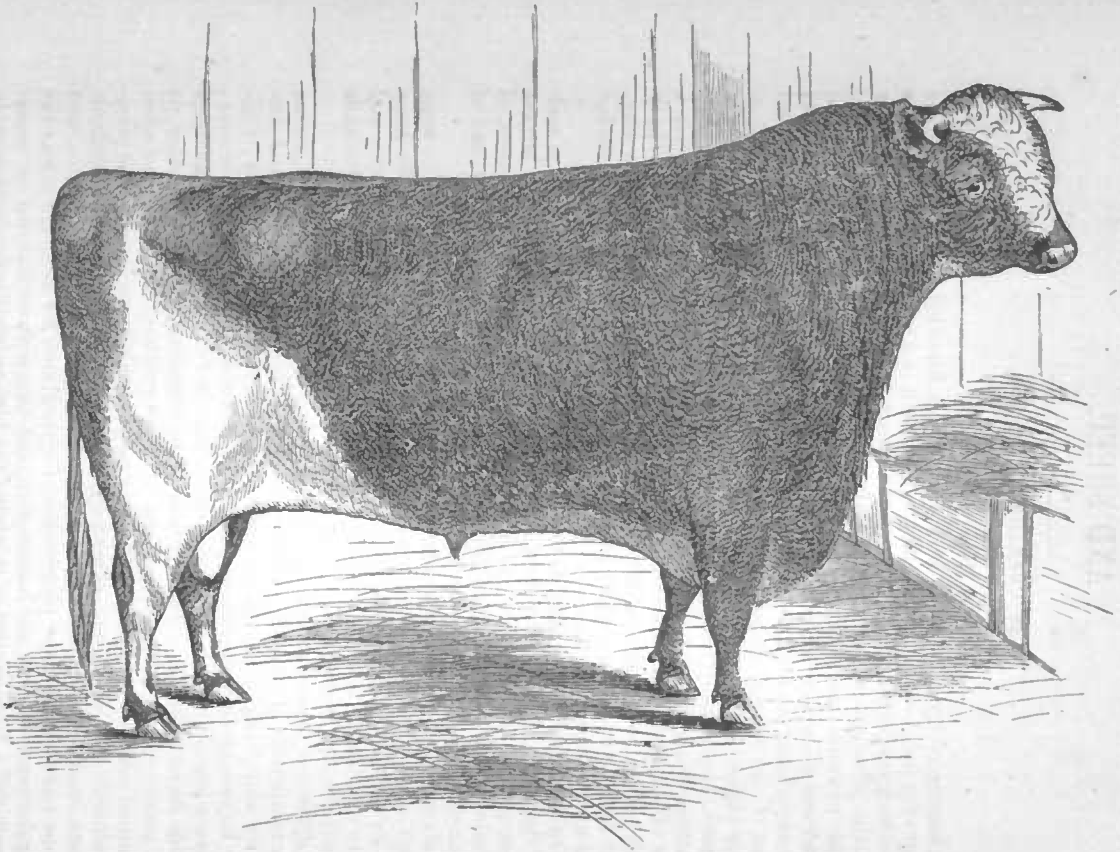
An importation of a small flock of Texel sheep was made by the writer in the spring of 1863. They were procured in Friesland, near the Texel, and shipped at Rotterdam, Holland, for the port of Boston, Massachusetts. The importation consisted of one ram and seven ewes when put on board ship, but on arrival at Boston, after a voyage of eighty-one days, the flock was found to have increased to seventeen animals, nine lambs having been produced on the passage, affording strong corroborative evidence of the good qualities of the ewes as nurses, and also of the hardiness of the breed.

The live weight of the ram of this importation, in good condition, is over two hundred pounds, and the ewes vary in weight from one hundred and forty-five to one hundred and seventy-five pounds each. Their fleeces average over ten pounds each, and their wool is considered by manufacturers superior to either the Cotswold or Leicester.

This flock now (1864) numbers about thirty head, and the experience with them so far leaves no doubt of their adaptation and economical value to this country.

The accompanying portraits are those of a ram and ewe of this importation.

Plate XXXII.



SHORT HORN BULL "MONITOR 5019.."

Five years old; owned by H. G. White, South Framingham, Mass.

IMPORTANCE OF RAISING AND FEEDING MORE CATTLE AND SHEEP.

BY CHARLES W. TAYLOR.

The science of agriculture has been defined as a knowledge of the principles which govern judicious cultivation; but, in truth, it is a collection of sciences or of scientific knowledge. A youth may soon learn the construction of a steam engine, the principles of its action, to take it apart and put it together, and to direct its powerful energy with his single arm; but, if its mechanism is to be improved and its utility increased, greater attainments, and higher skill, and greater experience are required. So in agriculture: the farmer may soon learn sufficient of the natural sciences to understand the common arts of cultivation, but their highest improvement requires a profound knowledge, not merely of one branch, but of many sciences, mutually related and reciprocally dependent.

To attain this higher art, it is not necessary that the farmer should pass a lifetime of study and experiment, but, with a general knowledge how to apply principles of science to those of art, he may be content to take the reasons why, on trust from those whose greater leisure and superior education have enabled them to unfold these great secrets.

Agriculture, as an art, relates to the successful cultivation of the soil; to such care of the field and herd as will enable the husbandman to realize the largest and most perfect products with the least labor and expense. The science of agriculture treats of the explanation and unfolding of these processes, and of the principles which govern practice.

In different localities and climates the art may vary, but science is the same here and everywhere. Art may mistake and give a particular soil the crops which its constituents disqualify it to produce; but science never errs, and therefore can decide upon the adaptation of one to the other, for she understands the constituents of both.

The difference between them appears from the course that each would pursue in the examination of the soil. Art regards its external appearance, and discovers its adaptation to a given crop often by a doubtful experiment, by traditionary knowledge, or by mere conjecture. Science adopts a different course; she takes a portion of that soil and puts it into her crucible, and by analysis ascertains its constituents. She also learns the constituents of the desired crops and of manures, and by a comparison of these results decides at once upon their mutual adaptation, or what changes must be made for success. The peculiar conditions of climate, soil, electricity, and other natural agents, so difficult to foresee, make all the principles of art and science hard of application, and hence one reason of the slow progression of agriculture; for although it was the first regular occupation of the human race, and has, without interval or cessation, employed a large portion of it, giving the highest civilization in proportion to its progress and perfection, and raising to power and opulence the people who most assiduously pursued it, yet it has not made that advance which might have been expected, even in those countries usually quoted as evidences of the most successful cultivation and the greatest learning.

Probably greater advance has been made within the last thirty years in the art of agriculture, by the application of science, in developing the principles, elucidating the mysteries, and showing the reasons of the operations of natural

causes, in every department, than for a century previous. As proof of thi witness our improved implements and machinery of husbandry, and our in creased knowledge of vegetable and animal physiology, by experience and b careful analysis of soils, of the various articles of food, and of the compositio of animal tissue.

However far we may fall below the highest excellence in our farming, w have certainly reason to congratulate ourselves on the advance that has bee made. Besides the more solid advantages, such as the adaptation of manures t soils, rotation of suitable crops, vastly improved machinery for planting, culti vating and gathering crops, draining and reclaiming land, turning swamps an barren fields into ornamental and fruitful lots, there is a growing attention t outward appearance, indicating taste, system, order, and an appreciation of th beautiful with the useful.

One of the most prominent points of improvement has been the more econom ical and judicious management of such of the domestic animals as form s large a portion of our food. The introduction of improved courses of husbandr has done much to advance us, but the attention that has latterly been calle forth to the adoption of every practicable improvement of which the business o a farmer is capable of sustaining has done much more.

The growth of new varieties of grain, of roots, and vegetables, has don immense good; these, assisted by improved culture and artificial manurings have wrought astonishing alterations, and great increase of produce on ever intelligent man's farm; but we think these have been exceeded by the improve ment made in breeding, feeding, and management of the live stock of the farm

Contrast for a moment the cattle of thirty years since, those which wer called "native stock," though owing their origin to every country of the Ol World—the long, high, thin, lean-fleshed, large-boned, hard, unthrifty animal of that day, with the compact rotundity of shape, the soft, mellow, thrift animals of the present day; the former fed at six and seven years, the latte making prime beef at three years old, and often killed earlier.

The same remark will apply to sheep and pigs, and not less to poultry Early maturity and quickness in fattening have been looked to as the decide characteristics in every variety of meat-producing animals.

The great improvement in cattle and sheep for the shambles consists in per fecting these three great cardinal points:

1st. The early period at which they are ripe for the butcher.

2d. The great amount of food they produce in return for the food they con sume.

3d. The large proportion of prime meat which they yield.

To treat of this subject understandingly, we should trace the origin of ou cattle and sheep, and the breeds, and the means used for their improvement.

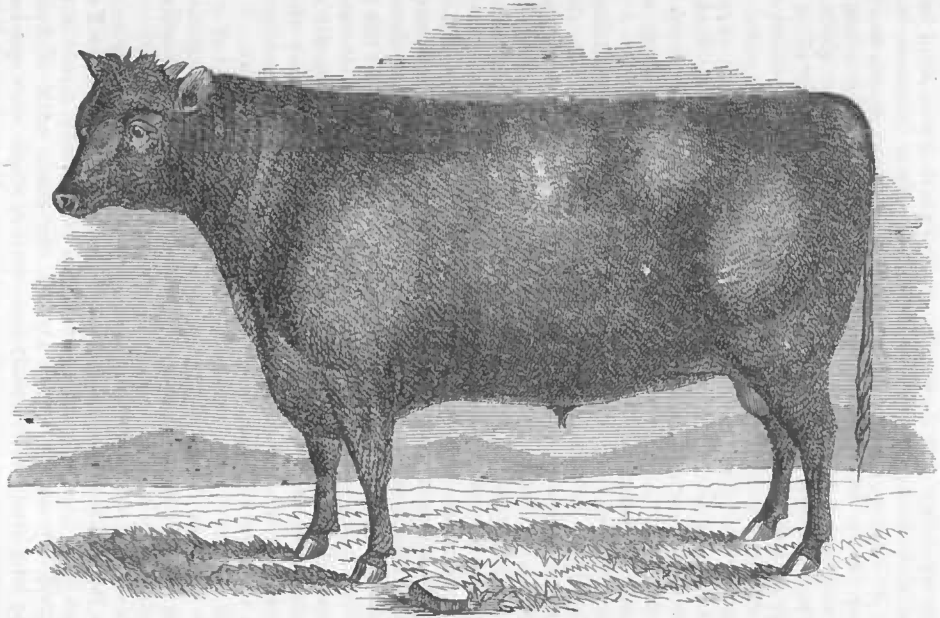
We quote to some extent the substance of the remarks of different writers i this country regarding the origin of what is called our "native stock," or th "native breed."

The term "breed," properly understood, applies only to animals of the sam species, possessing, besides the general characteristics of that species, othe characteristics peculiar to themselves, which they owe to the influence of soil climate, nourishment and habits of life to which they are subjected, and whic they transmit with certainty to their progeny.

The characteristics of certain breeds or families are so well marked, that if a individual supposed to belong to any one of them were to produce an offsprin not possessing them, or possessing them only in part with others not belongin to the breed, it would be just ground for suspecting a want of purity in th blood.

If this definition of the term "breed" be correct, no grade animals, and n animals not possessing fixed peculiarities or characteristics which they shar

PLATE XXXIII.



DEVON BULL.

Owned by N. Washburn, Worcester, Mass.

with all other animals of the class of which they are a type, and which they are capable of transmitting with certainty to their descendants, can be recognized by breeders as belonging to any one distinct race, breed, or family.

The term "native" is applied to a vast majority of the cattle of our country, which, though born on the soil, and thus in one sense natives, do not constitute a breed, race or family, as properly understood by breeders. They do not possess characteristics peculiar to them all, which they transmit with any certainty to their offspring, either of form, size, color, milking or working properties. But though an animal may be made up of a mixture of blood almost to infinity, it does not follow that for specific purposes it may not, as an individual animal, be one of the best of the species; and for particular purposes, individual animals might be selected from among those called natives, equal, and perhaps superior, to any among the races produced by the most skilful breeding.

There can be no impropriety in the use of the term native, as applied to our cattle or sheep, therefore, when it is understood as descriptive of no known breed, but only as applied to the common stock of the country, which does not constitute a breed. But perhaps the whole class of animals called natives would be better described as grades, since they are well known to have sprung from a great variety of cattle procured in different places and at different times on the continent of Europe, in England, and in the Spanish West Indies, brought together without any regard to fixed principles of breeding, but only from individual convenience and by accident.

The earliest cattle imported into the Plymouth colony, and undoubtedly the earliest introduced into New England, were brought over in 1624. At the division of cattle which took place in 1627, three years after, one or two are distinctly described as black or black and white; others as brindle, &c., showing that there was no uniformity of color. Soon after this date a large number of cattle were imported for the settlers of Salem and its vicinity; and in 1631–'32 and '33 several importations were made into New Hampshire by Captain John Mason, who, with Gorges, procured the patents of large tracts of land in the vicinity of Piscataqua river, and immediately formed settlements there. The object of Mason was to carry on the manufacture of potash, and for this purpose he employed the Danes, and it was in his voyages to and from Denmark that he procured many Danish cattle and horses, which were subsequently diffused over that whole region and sold, large numbers being driven to the vicinity of Boston. These facts are authenticated by original dépositions and documents now on file in the office of the secretary of state of New Hampshire.

The Danish cattle are there described as large and coarse, and of a yellow color, and it is supposed that they were procured by Mason as being best capable of enduring the severity of the climate and the hardships to which they were to be subjected.

However this may have been, they very soon spread among the settlers of Massachusetts Bay, and have undoubtedly left their marks on the stock of New England, which exist to some extent even to the present day, mixed in with an infinite multitude of crosses with the Devons, the black cattle of Spain and Wales, and the long-horn and the short-horn, most of which were accidental, or due to local circumstances or individual convenience. Many of these New England cattle were of a very high order of merit, but to what particular cross it is due it is impossible to say.

They make, generally, hardy, strong and docile oxen, easily broken to the yoke, and quick to work, with a fair tendency to fatten when well fed; while the cows, though often ill shaped, are sometimes remarkably good milkers, especially as regards the quantity they give.

Cattle were imported into Virginia at an earlier date than into Massachusetts, for as early as 1610 an edict was passed by the governor prohibiting the killing of any domestic animals, among which are mentioned neat cattle, on penalty of

death to the principal offender—burning in the hand and loss of ears to the accessary, and twenty-four hours whipping to the concealer.

Sir Thomas Gates brought into Jamestown in 1711 a large importation of a hundred head from Devonshire and Hertfordshire. Cattle were also imported into Delaware by the Swedes, sent out by Gustavus Adolphus in 1627.

The Spaniards also, at a very early period, introduced them into the West Indies, whence they were afterwards carried to the continent, and from which the wild cattle of Texas and Mexico were derived.

An importation of Dutch cattle from North Holland to this country was made as early as 1625 by the Dutch West India Company, and in years subsequent to that several similar importations were made by settlers in New York, then the New Netherlands.

The first English cattle taken into the west were what was called the "Patton stock," so called from Matthew Patton and his son John, who brought them from Maryland to Kentucky, and afterwards to Chillicothe, Ohio.

The importation of this stock from England was by a Mr. Goff, of Baltimore, in 1782. They were, I believe, of the Teeswater or the Holderness breed. And these again had been changed and improved by the introduction among them of the Holstein cattle from the continent. This was a good milking stock, and a very good one for feeding; but in the rich pastures of the west they grew coarse, as well as large, and went into disfavor. From these varied sources, variously intermingled, the so-called native stock of this country was produced.

Not far from this time Charles Colling commenced on this same stock his refining process, which has given to the world the noble "short-horns" as a breed and rendered his name immortal. During the last half century not a year has passed that importations of some of the most improved breeds have not been made; and we have so advanced in our own breeding as to have been able to return to the English breeders improvements on their own stock, as has been done by Mr. Samuel Thorne, of Thorndale, New York, who, in 1860, only seven years after his importation, returned to England five young bulls and a heifer, purchased by some of the most eminent breeders there. Some of these bulls and their progeny have during the past year taken first prizes at some of the English shows.

Till within about thirty years the principal importations of short-horns had been confined to New England, New York, and Pennsylvania, made by gentlemen whose taste and patriotism prompted them to do what their wealth enabled them to do. Since that time, besides private importations, many choice cattle have been brought in by stock-breeders' associations in Ohio, Kentucky, Indiana, Iowa, and perhaps other States.

Very excellent cattle have been imported into and bred in Canada.

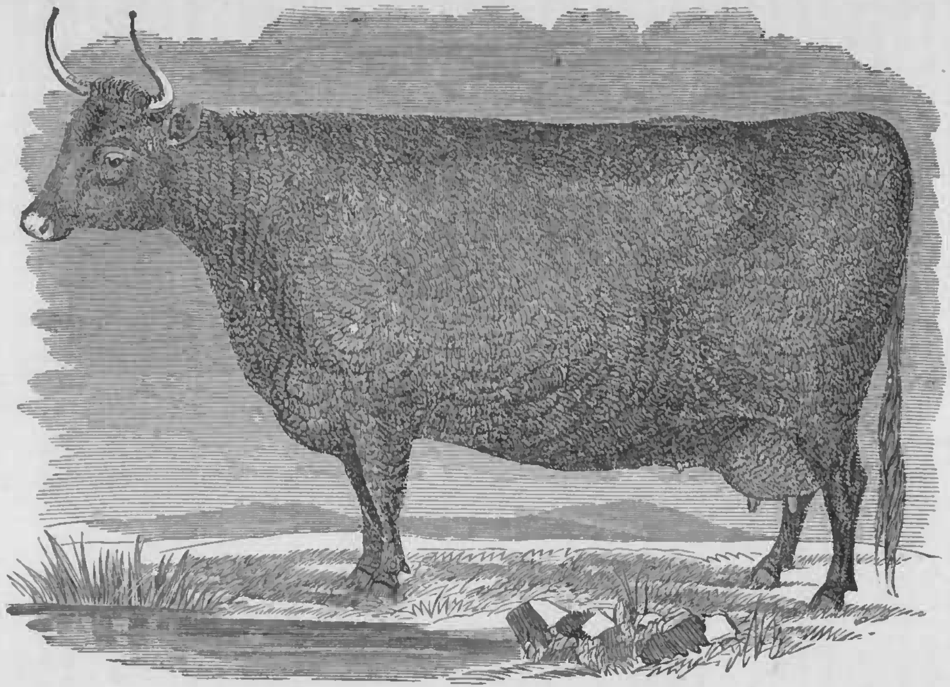
Pedigrees of short-horned cattle are now as carefully looked to as title-deeds.

In 1822 George Coates, an enterprising breeder, commenced the English Herd Book, which has continued to the present time, and contains a record of nearly all the best pure-bred short-horns.

In 1846 Lewis F. Allen, now of Black Rock, New York, a laborious worker, a keen, shrewd judge of stock of all kinds, and an enthusiastic admirer and breeder of short-horns, published the first volume of the American Herd Book. Some years after he continued it, till six volumes are now out. This book, like the English Herd Book, is one of great labor and corresponding value. Either of them is regarded as *authority;* and the American Herd Book should be owned by every breeder of short-horns.

The introduction of sheep into the country was as varied as that of cattle. The first were probably brought to Jamestown, Virginia, from England, in 1609. These did not increase very rapidly, or they were destroyed in large quantities; for in 1648, forty years after, we find them numbering nearly three

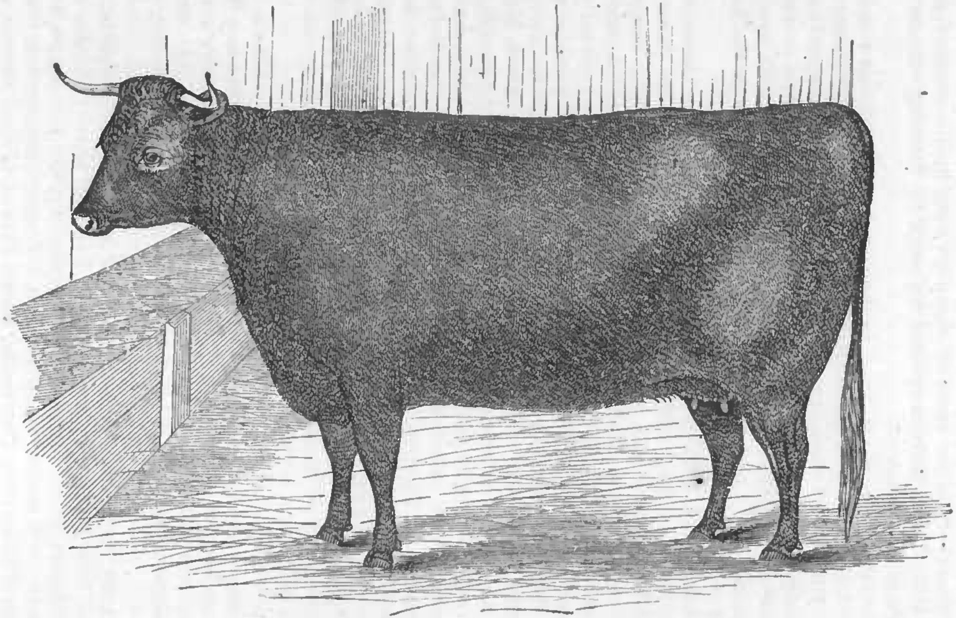
PLATE XXXIV.



DEVON COW "BEAUTY."

Owned by H. Washburn, Worcester, Mass.

Plate XXXV.



DEVON HEIFER "FAIRY 9th"

Bred and owned by E. H. Hyde, Stafford, Ct.

thousand, when there should have been at least twenty thousand. Exportation was forbidden by law.

Sheep were first brought into New York, or the province of New Netherlands, by the Dutch Company, in 1625, and after that, in 1630, from Zealand and Texel. The ravages by wolves and dogs, however, principally the latter, nearly destroyed the enterprise; for, thirteen years afterward there were not over sixteen sheep in the colony. Dogs have from that time to the present—two hundred and forty years—been the curse of sheep-growing in this country, and will, till the "fool-killer" shall have completed his work by thinning out the most of the legislatures of the country.

Into Massachusetts sheep were brought prior to 1633—as mention is made of their being taken on to one of the islands for protection against wolves and dogs. In 1652 Charlestown numbered four hundred; and as early as 1658 Mr. John Josselyn, in his Voyages, speaks of there being seven or eight hundred sheep in the town of Blackpoint, in this province. In 1676 Edward Randolph, a commissioner of the crown, says, in his correspondence with the home government, that "New England abounded in sheep."

The so-called native sheep of this country were generally coarse, unprofitably shaped animals, usually with white faces, though in some parts there were brown and black faced ones, which were undoubtedly Sussex sheep, imported before the improvement of those valuable animals by John Ellman.

From these early dates to the present time there have been annually successive importations of sheep as of cattle, many of them originally made without any regard to the fitness for any locality or climate. The merino sheep were first brought into the country by Gen. Humphreys, of Connecticut, Mr. Jarvis, of Vermont, and Mr. Livingston, of New York. These were Spanish sheep, and, having now been bred in this country for so many years and thoroughly acclimated, are now often called American merinos, and are far superior to any sheep on the continent of Europe, as was well shown at the exhibition in Hamburg, when some American merinos from Vermont, exhibited by George Campbell, took the first prize over all others. Some of our best breeders, however, prefer to retain the name of "Spanish merinos," as more indicative of a direct line of unmixed descent from some of the famous flocks of Spain, as the Infantados or Paulars, which are believed to have been kept pure.

The improvement and refinement of these sheep is due to Edwin Hammond, of Middlebury, more than any other man in the country. For more than twenty years he has bred these sheep, directly of General Humphreys's importation from Spain, with all the patience, skill, and perseverance that characterized Robert Bakewell, of Dishley, but with vastly more honesty, honor, and public spirit.

The Saxony sheep were introduced about 1823, for their superlative fineness of wool, but, except in a very few localities, have not proved suitable or popular, their light fleeces being insufficient protection against the rigors and changes of our climate. Of mutton sheep we have had many importations from England and Canada of Leicesters, Cotswolds, South Downs, Oxford Downs, and Shropshire Downs, which have crossed with advantage on our native sheep.

The "native stock" of cattle has been constantly improved by the introduction for beef or the dairy of the short-horns, Ayrshires, Herefords, Devons, and Jerseys or Channel Island cattle, with an occasional one of the Dutch or Holstein blood. Latterly these have been imported with care and bred with skill, either pure or crossed on native stock, for the shambles or the dairy, as was most desirable.

The short-horns are generally the greatest favorites for beef from their large size and early maturity, though not making so fine beef as the Devons or Herefords.

The Ayrshires give the greatest flow of milk, the Jerseys the richest, and the Devons make the best workers.

No doubt the crossing of these breeds with our natives, and recrossing back in various ways, has helped very much to improve our old stock, by adding to them some one or another of these desirable qualities. We have better milkers, we have better beef-cattle ripening at three years instead of six or seven, and fattening easier, and our working oxen are much improved; though in many parts of the country, as it becomes more cleared and settled, we find that horses are to a considerable extent superseding for farm work the patient ox. In many parts, however, oxen will continue to be used and appreciated, and will be better trained.

The proportions of cattle to the people, existing or required, have been the subject of examination and comment in foreign countries, but have not until recently attracted close attention here. A very interesting article in the last Report of the Department of Agriculture develops the fact, according to the census of population and cattle since 1840, that every one hundred people require eighty neat cattle; that eight of these cattle must be working oxen, and that this requirement has not varied a single per cent. in thirty years; that twenty-eight of the eighty must be milch cows, and that this number has not varied one per cent. for the past thirty years. For the first time we are enabled to know when a demand for neat cattle exists and where the supply may be obtained. Hitherto the supply has met the demand without any definite knowledge of what value was required or from what source it could be best supplied. The deficiencies or excesses existing in each State were only very generally or vaguely known, and we rested satisfied when we ought to have availed ourselves of every means of information carefully and fully, and then to have endeavored to prevent or counteract the diminution of the supply already become deficient. For example, Massachusetts had less than one-half the requisite number of cattle within her limits in the year 1840. In the year 1850 she had less than one-third, and in 1860 but about one-fourth the number of cattle required for the support of her population; she must, therefore, import beef, butter, and cheese, having but a scanty allowance of milk. Where will she obtain these articles? This, as the writer justly remarks, is a most interesting and important question. Where is the redundancy of production that is to fill the deficiency caused by her consumption? New York, Pennsylvania, New Jersey, Delaware, and Maryland have not enough to supply their own wants; she must, therefore, transport from a great distance to supply her deficiencies. She must reach out into our western regions, and outbid in price all intervening demand. The same of all the middle States, except, in the fact of their lying nearer to the sources of supply and production, they have so much less freight to pay on what they must transport for the consumption of their own people. Now the very important question to which attention is specially called in the present article is, cannot the people east of the Alleghanies, by more careful husbandry, by paying more attention to grass lands, meadow and pasture, by growing larger crops under better cultivation, by a skilful and judicious feeding of those animals, both neat cattle and sheep, which by careful breeding yield the largest return in beef and mutton for the food given them, make the raising and feeding of cattle profitable, and thus save within their own limits some part of the immense amount of money which fannually goes towards the setting sun to pay for western beef?

As the eastern portion of our country becomes more densely settled; as manufactures, mining, commerce, and all other non-producing occupations and professions multiply; as the country becomes more thickly peopled; as villages draw in their houses around them and become towns; as towns expand their limits and become cities; as cities pile up their houses heavenward and fill them with hungry occupants, of course a greater demand must be made upon the

Plate XXXVI.

SHORT HORN HEIFER "LADY MARY."

Twelve months old; owned by H. G. White. South Framingham, Mass.

remaining country to supply them with food. This necessitates either a higher state of cultivation and greater production in the remaining territory, or an importation from some other district or territory where production exceeds consumption, or perhaps both, as is the case in England, where their cultivation is immensely improved, and their system of feeding carried to the highest point; yet they import from Holland and other parts annually a hundred thousand neat cattle, three hundred and twenty-five thousand sheep and lambs, and twenty-five or thirty thousand calves. In this connexion a curious fact is developed, showing the material advantage of high cultivation of land and stock, that while the population has been steadily increasing, and while the prices of beef and mutton within a dozen years have advanced from fifteen to twenty per cent., the imports of beasts and sheep have been gradually declining since 1850.

The result of this natural law, that a deficiency in and consequent importation of cattle must follow whenever the population increases faster than the cattle, is most strikingly illustrated in our country from the extraordinarily rapid increase of population, and also by the uses made of our great lines of railway for transporting cattle, live and dead meat, hundreds of miles from those regions where they are most cheaply produced, abounding in numbers, exceeding the proportion required for the consumption of the people of those districts where they are grown.

Meat, butter, cheese, and milk must be imported, and the prices of these articles will depend upon the distance necessary to transport them and the number of profits added to the original cost, and these at times have been reduced so low as to make it impossible for the farmers of those portions of the country most thickly settled to feed cattle at a profit.

When the corn meal necessary to fatten a bullock is worth more to the farmer in Massachusetts or New York than it would cost to bring a bullock of equal weight from Illinois, it is evident that other circumstances besides the profit on the carcase of the ox must control him, and generally the moving cause is the necessity for the manure. It is quite impossible to obtain from any statistics the whole amount or any just approximation to it of the amount of meat sent by the great producing portion of the country to the consumers. A few items will give some idea of it.

In 1862 there were sent eastward from

CHICAGO.

	Quantity.	Value.
Cattle .... number..	109,304	$3,279,120
Hogs, live .... do....	446,425	3,248,128
Hogs, dressed .... do....	44,609	356,872
Beef .... barrels..	149,838	1,758,056
Pork .... do....	192,549	1,925,490
Cut meats .... pounds..	71,840,797	4,310,448
Lard and tallow .... do....	63,937,054	5,119,560

MILWAUKIE.

	Quantity.	Value.
Beef .... barrels..	38,380	$436,692
Pork .... do....	56,434	564,340
Cut meats .... pounds..	5,382,625	322,958
Lard and tallow .... do....	6,284,248	509,207

As the classification of freight over the principal connecting railroads between the east and west is very incomplete, we can only state some disjointed facts.

In 1862 there were received and sent east from—

	Cattle.	Value.	Hogs.	Value.	Sheep.	Value.
Buffalo........	129,433	$6,471,650	524,976	$3,674,832	105,671	$317,013
Dunkirk	46,989	2,349,450	258,089	1,806,513	21,454	64,362

From Pittsburg there seem to have been sent east about 147,000 tons of live stock of all kinds, and 505,000 tons of salt meats.

These figures, though very incomplete, give some idea of the amount of cattle drawn from the abundance of the west to supply the deficiency of the east, and the following tables will show to some extent where they have gone. New York, of course, consumes more of them than any other single market. The cattle market report of the New York Times shows the annual and the weekly receipts at that point, and says, "Beef is the standard meat, and a pretty uniform supply is sold throughout the year. Milch cows run pretty regularly between February and October. Veal calves arrive more largely in August and September; sheep and lambs from shearing time in June to the close of the year, while live hogs arrive mainly in November and December."

The following table gives the total receipts of animals for each of five years past:

Years.	Beeves.	Milch cows.	Veal calves.	Sheep and lambs.	Live hogs.	All kinds.
1864..................	267,068	7,576	76,361	777,990	657,092	1,786,087
1863..................	263,229	6,715	38,278	522,311	1,096,773	1,924,898
1862..................	235,660	5,253	30,258	175,722	1,098,712	1,845,605
1861..................	226,023	5,816	33,383	527,358	598,509	1,387,327
1860..................	226,747	7,154	40,162	514,191	319,628	1,107,882

A marked increase is shown in the supply of veal calves for 1864. This is partly due to the severe drought in midsummer, and the consequent high price of dairy products, which induced dairymen and farmers to sell off an unusual proportion of calves to save the milk they would consume. The high price of meats also tempted them to sell the large or half-grown calves. This waste will lessen the future supply of cattle by some 40,000 head. The receipt of live hogs has fallen off the previous year 439,681 head—partly due to the former short corn crop, and partly to the revival of the pork packing at the west, where it had been partially suspended during the war.

The following table gives the average weekly receipts for the whole year during each of five years past:

Years.	Beeves.	Cows.	Veals.	Sheep.	Swine.	All kinds.
1864........................	5,136	149	1,406	14,961	12,636	34,348
1863........................	5,062	129	698	10,044	21,092	37,817
1862........................	4,502	101	582	9,149	21,120	35,492
1861........................	4,265	110	680	9,950	11,292	26,176
1860........................	4,360	138	772	9,888	6,147	21,305

This table will be found very useful for future reference by those who are dealing in the New York market. As the prices obtained usually depend much upon the supply, the distant owner of stock will be able to judge of the probable wants of the market by comparing with the above table the supply received for two or three weeks previous on market day.

Having shown that a deficiency in neat cattle exists everywhere east of the Alleghanies, and that it is also making westward as the population thickens; and as we have, in showing that this deficiency must be made up either by importation or improved culture or both, demonstrated, though imperfectly, the extent of the importation, and the direction whence it comes, we now turn to the other source of supply at our command—increased production by higher cultivation; and it is, in our judgment, a matter worthy the serious consideration of all intelligent farmers.

As meat, and especially the flesh of neat cattle and sheep, constitutes a very important part of our food, it is well to consider somewhat the constitution of it, and how it is made.

It is a well known fact that the quality of meat, and the average amount of it consumed, varies in different countries, and that the consumption of it is very materially influenced by climate. It is observed that in hot countries man consumes but little animal food; that under the equator it is chiefly a vegetable diet that is adopted; that it is only from the want of the requisite supply of garden vegetables that men are driven, in some of the warmer portions of the southern half of this continent, to subsist entirely upon beef. As a general rule, however, the consumption of meat increases as we progress from the equator towards high northern latitudes. Even in countries so closely adjacent as England and France, the difference is strongly in favor of the more northern nation, the yearly consumption of meat in England being about seventy-five pounds per head, while among the French it is only about twenty-five. It is not unlikely, however, that other causes may tend to occasion this, besides the mere difference of temperature and climate, which hardly seems sufficient to account for so great a difference in so nearly the same latitude.

Wrong notions are usually entertained as to the composition of meat. Few persons are aware that uncooked meat contains nearly four-fifths its weight of water, yet such is the fact. Lean beef contains in 100 parts—

Water and blood	78 parts.
Fibrine or gluten	19 "
Fat	3 "
	100 "

When the meat is dried, as in the pemican or in jerked beef, 100 parts contain—

Fibrine or gluten	84 parts.
Fat	7 "
Blood, &c	9 "
	100 "

The composition of meat is little altered by cooking; the chief loss of weight which is then experienced consists of water. In some experiments made at a public establishment it appeared that—

100 pounds of beef lost in boiling	26 lbs. 8 oz.
100 pounds of beef lost in roasting	32 lbs. 0 oz.
100 pounds of beef lost in baking	30 lbs. 0 oz.

100 pounds leg of mutton lost in boiling	21 lbs. 5 oz.
100 pounds of shoulders lost in roasting	31 lbs. 5 oz.
100 pounds loin of mutton lost in roasting	35 lbs. 8 oz.
100 pounds necks of mutton lost in roasting	32 lbs. 6 oz.

The greatest loss of nutriment which the meat sustains by cooking is by boiling, but the extent of this loss is very materially influenced by the mode in which the boiling is performed; and here it is commonly the case that two rather incompatible objects are sought to be obtained. It generally happens that an attempt is made to combine the preparation of boiled meat with the production of good broth or soup.

Liebig has explained the philosophy of these operations in his "Letters on Chemistry." If the mass of flesh intended to be eaten be introduced into the boiler when the water is in a state of brisk ebullition, if the boiling be kept up for a few minutes, and the pot then put in a warm place so that the temperature of the water be kept at 158 to 165 degrees, we then have united the conditions for giving to the flesh the qualities which best fit it for being eaten. When it is introduced into the boiling water the albumen of the flesh is immediately coagulated on the surface, and to a certain extent inwards, thus forming a skin or shell which no longer permits the juice of the meat to flow out nor the water to penetrate the mass. The flesh continues juicy and well flavored, the greater part of the savory constituents being retained in the meat.

On the other hand, if the mass of flesh is set on the fire with cold water, and this slowly heated to boiling, the flesh undergoes a loss of soluble and savory matter, while the soup becomes richer in these.

The albumen is gradually dissolved from the surface to the centre; the fibre loses, more or less, its quality of tenderness, and becomes hard and tough. The thinner the piece of meat the greater its loss of savory constituents.

This explains the well-known observation that the mode of boiling which yields the best soup gives the toughest, driest, most vapid meat, and that in order to obtain well-flavored and eatable meat we must relinquish the idea of making good soup from it.

If finely chopped meat be slowly heated to boiling with an equal weight of water, kept boiling for a few minutes, and then strained and pressed, we obtain the very strongest and best-flavored soup that can be made from flesh.

When the boiling is longer continued some little organic matter is dissolved, but the flavor and other properties of the soup are thereby in no degree increased or improved. By boiling, mutton may be regarded as losing about one-fifth of its weight, and beef about one-fourth. By roasting, mutton and beef lose each about one-third of their weight; mutton is, however, the most nutritious meat.

In considering this branch of the question, an important item is the quality of meat, whether lean or fat, from young or old animals, &c. Objection is often made that beasts are made too fat for profit or for wholesome food, and this is doubtless often the case; but it may be assumed that beef and mutton cannot be too fat, when the fat and muscle are properly mixed, and of good quality and fair proportions separately. Muscle and fat have individually different qualities, as well as when the two are mixed together. The muscle of the ox, for instance, is different from that of the sheep, swine, poultry, or fish, and the muscle of one ox from that of another, and as different to the taste as in appearance; so, also, the fat; both are affected by age. If the two are good separately, they cannot be of bad quality when mixed together in proper proportions, or in what is usually termed fine-grained meat.

Muscle, or, in common language, flesh, constitutes by far the largest part of the body, consisting of a system of fibres, usually parallel to one another, and bound together in bundles. Each fibre or thread, as seen by the naked eye, is, when examined by the microscope, composed of a number of smaller fibres

forming smaller bundles similar to the larger one. Both the large and small are bound together by, or sheathed in, cellular tissue, every one of these smallest fibres being also surrounded with tissue, and the whole liberally supplied with nerves and blood-vessels. Flesh is, therefore, a compound of various substances, principally four in number—albumen, lactic acid, salts, and extractive matter. It is this latter which gives to roast and boiled beef their peculiar flavor. It is stronger in some animals than in others, and in aged than young; hence a frequent complaint by old epicures and acute judges of meat, that they do not so often as formerly get the rich-flavored roast beef and gravy of former years, as the beef is killed younger.

Formerly, few oxen were killed before six years old, while now a majority are probably slaughtered at three, or often two. It is to the proportional difference of the solids and liquids, as well as the presence of foreign matter, that are to be attributed differences of the quality of the lean and fat meat. If the exhalents of the skin and lymphatics, for instance, are inactive, we cannot expect the same quality as otherwise. If animals are slaughtered in an excited state, or if they have been laboring under violent excitement immediately before being slaughtered, and the system not restored to a healthy state before being killed, the meat will be injured. Hence it is that the flesh of cattle carried to market in railroad cars is often so injured as to make it unfit for use—certainly for preservation; and the same must follow when cattle are driven hurriedly and violently to the slaughter-house; heated and worried, in a feverish state, they are knocked in the head, to the injury of the meat and the discredit of the butcher.

Suppose it to be a bullock, two or three years old, of prime quality, and of the highest degree of fatness, well laid on. Ten days, perhaps, have expired since he was taken from the rich pasture, or the stall of the farmer, before he was slaughtered, during which time he was half starved and in a state of excitement from travelling by railroad, fatigue in marketing, and exposure to the vicissitudes of the weather; during this time he has been but scantily fed and watered, and that at very irregular intervals; consequently, the stomach and bowels become deranged, the transpiration stopped, or nearly so, and, in short, the whole system was in a febrile state—a complication of maladies which the animal might have gotten over by resolution had it not been slaughtered in this state, the virus of the complaint being carried off in the urine, or by a discharge from the nostrils, or by some affection of the skin; but not being so carried off, it remained in the meat, innoculating it, converting the mass into a state of corruption in a very short time in warm weather, if not sold and consumed immediately after being slaughtered; besides, animals in this state never bleed well. When they leave home, they may promise the best beef a farmer ever fed, but forty-eight hours after being slaughtered in the heat of summer it is likely sent to the dogs'-meat man and the tallow-chandler.

There has not been sufficient attention paid to this formerly, though its importance is being recognized and acted on by butchers, the wisest of whom prefer to have their cattle and hogs "cool off" before slaughtering. The attention of the army officers has been especially called to it, that they should not immediately kill cattle hurried into camp, if it could be avoided. Cattle are now mostly carried to market, and, in addition to being knocked and jammed about, unfed and unwatered, trains are frequently detained many hours, and days even, with no conveniences for taking care of them; and besides the injury to the flesh, there is a large shrinkage in the weight of good cattle. amounting to some hundreds of pounds. We heard one drover, whose cattle from the west had been detained some days on the New York Central railroad, declare that the average loss of weight was not less than five hundred pounds per head.

This great shrinkage strongly corroborates our statement, that the fat was

rapidly consumed to supply the carbon required, and to make up for food and shelter. This generally comes hardest, too, on the two and three year old bullocks, who are not as well able to endure the hardships of transportation as the older oxen, who master them, and who are stronger and generally more quiet in their disposition. Fat is composed of two substances, stearine and oleine, mixed in different proportions, not only in the ox, sheep, and pig, but also in individuals and different beasts. Its object is of a two-fold character—for lubricating the muscles, making them play freely among each other, and for respiration and transpiration, or to supply the lungs with carbon, in the absence of such being derived from food, and that emitted from the skin in the sensible and insensible perspiration, in both cases keeping up the heat, reparation and health of the body.

During life, or so long as the blood, or rather the whole fluids, continue to circulate, the muscular system may be compared to a perpetual motion, obviously incurring a large waste of power. It is a well-authenticated fact that, if the exhalents of the skin are shut but a very short time, the whole system is deranged, obviously proving that a large quantity of deleterious matter has not been carried off as it should have been.

Such, therefore, being the facts of the case, it is manifest that the most economical disposition of the fat is immediately when it is required for use, or mixed with the muscle, forming what is termed finely grained meat. When of the best quality, ox fat has a clear and pinky-white appearance.

Such being the nature of the lean and fat of butcher meat, the soundness of our conclusion will readily be appreciated, that there is never any loss experienced on the table by too much of the latter being mixed with the former. We sometimes see animals where the fat and lean do not mix properly, the former being deposited in large masses on particular parts of the body, as the rump, hook-bones, ribs, &c., separate from the lean, or comparatively so, often called by butchers "patchy." There is undoubtedly some constitutional defect in connexion with the adipose tissue.

Flesh always contains more or less fat for the purpose of lubrication, and when there is a deficiency of this the fibres are hard and tough, and in no case are they so good as when properly grained; in these cases the fat, although free from disease, is inferior in quality when stored up irregularly, the greater portion being deposited in large masses together, or in layers in the cellular membrane which divides the different sets of muscles, as when they cross each other, &c., but in the interior of the large and small bundles of fibres already noticed there is comparatively no extra quantity stored up, so that certain parts of the animal only take on fat, while others remain comparatively as they were when it was put up to fatten.

In the full consideration of the very important subject before us, we have stated that one of the means to be used and practiced to prevent the constant diminution and consequent high price of cattle east of the Alleghanies, was to increase the number by breeding and raising the calves.

We are quite aware that the high price of milk, butter, and cheese, ready transportation to market from every part of the country, the popularity and high price of veal, all furnish irresistible temptations for the farmer to slaughter his calves rather than to raise them; but a continuation of this practice will eventually show it to be a losing business.

In the hope of being able to do something to stop this perpetual drain, we propose to say something of the raising of calves.

Every farmer knows practically, if not theoretically, the ordinary mode of making an animal ready for the butcher. The latter are, as a class, good judges of the quality of beef and mutton which are in daily want by their customers, and unless animals of this description are prepared for them, they decline purchasing.

There is thus a necessity laid on all farmers who make their living by rearing and feeding cattle to be up to the mark, and it will be generally agreed that rearing calves is the first step and a very important one.

Calves are either allowed to suckle their dams, or, as is generally practiced, fed from the pail by hand. The former being the natural mode of rearing, little attendance personally or labor is required; and if the principal object is to make a good beast, what can surpass the food provided for and given by nature in the usual way?

But, as already hinted, there are far more calves reared by hand than by suckling, and first-rate animals are reared and fed in this manner. When a calf is first dropped it is covered with a thick slime, which nature teaches the cow by instinct to cleanse by licking it off; and if she shows any disinclination it is not uncommon to induce her to do so by sprinkling it with a little salt and fine oat meal. This is necessary for the calf's comfort, cleanliness, and health, and is thought by many to be usefully medicinal to the cow, and, on every account, should be regarded and encouraged.

If the calf is permitted to suck the cow, it will be more difficult to make it take its meals from the pail, and also fret and annoy the cow, which will not give its milk freely, but retain it for its offspring. But though it will be necessary to prevent the calf sucking its dam for these reasons, it should be fed on the cow's first milk, which nature designed as its most important food, as it is also medicinal, cleansing the bowels of the fecal matter secreted there during its confinement in the womb. The calf should, therefore, get a sufficient portion of this naturally medicinal agent three or four times a day, a pint and a half at a time, so as not to keep it fasting too long, and at the same time not to overload its stomach.

After the calf is a week old a little skim-milk may be gradually mixed with the new milk, and after a fortnight a little fine oat-meal or linseed-oil meal mucilage may be added gradually, which will enable the industrious and economical housewife to save her milk for butter and cheese, and to raise her calves also.

Professor Johnson, in his "Lectures on Agricultural Chemistry," says, "that while the calf is young, during the first two or three weeks, its bones and muscles chiefly grow. It requires the materials of these, therefore, more than fat, and hence, half the milk it gets at first may be skimmed, and a little bean meal mixed to give it more of the casein, out of which the muscles are formed. After this more fat is required, and soon all the milk the cow would give. This, however, makes a costly food, and instead of the cream a less expensive kind of food may be used. Linseed meal may supply, at a cheap rate, the fat which, in the form of cream, sells for much money, and instead of additional milk, bean meal in larger quantities may be advantageously used."

This suggestion has been followed with great success by some farmers in Great Britain and Ireland, and adopted as a system founded on tried chemical and physiological principles in quantities and composition.

Their rule is to pour thirty quarts of boiling water on three quarts of linseed meal and four quarts of bean meal; it is then covered up close, and in twenty-four hours after added to thirty-one quarts of boiling water then on the fire, pouring it in slowly and stirring constantly to prevent lumps, and to produce perfect incorporation. After boiling thirty minutes the prepared mucilage, or gruel, is put by for use, and should be given blood or lukewarm to the calves, mixing it in small quantities at first with the milk, say one-fourth mucilage with three-fourths milk, progressively increasing it, so that by the end of a fortnight it will be in equal parts; by the end of the third week, one and a half mucilage to one of milk; by the fourth week the mucilage may be given in double the quantity of milk, and skim-milk substituted for new; and by the end of the sixth week the mucilage will be gradually increased in the proportion of two and a half to one of milk, and from that out to the tenth week the milk may be

gradually reduced so that they may be fed wholly on mucilage till they are fifteen or sixteen weeks old, when they can be entirely weaned.

During all this time they should be comfortably housed, well ventilated, and kept perfectly sweet and clean, with a little sweet hay tied in bundles and suspended so that they may play with it and learn to nibble and eat it, and a little pounded chalk mixed with salt given in troughs to lick at pleasure, which prevents acidity in the stomach, and the readier formation of cud. Small lumps of linseed-cake should also be given in other troughs, which they will soon learn to suck if the pains are taken to put a bit of it in their mouths after their meal of mucilage.

When housed there should be a separate pen for each calf, of sufficient size to enable it to walk about, and to prevent a habit they are apt to get, of sucking each other's ears, and swallowing the hair, which, uniting with the cud, forms round balls, which are indigestible, and often cause death to many a promising animal.

The following scale of quantity of milk, or mucilage combined, for each calf, has been used, but may be altered according to circumstances:

From the first to the third week the calf may get from four to six quarts daily; the third to the sixth week, six to eight quarts; the sixth to eighth week, ten to twelve quarts; and so increasing the quantity about a quart a day until entirely weaned.

This system is undoubtedly calculated to make strong and rapid growth, and would result in splendid animals, and at a comparatively small expense, by saving the milk. It would be well if farmers would adopt this plan of starting their calves. Some parties do not give so much liquid food per day, but make it up by giving them finely cut roots, oat-meal, &c., but the animals are too young for much of such food, though it is a good plan to teach them to eat roots early.

Hay tea is an admirable thing also to mix with the mucilage and milk, as it contains a large amount of nutriment in a soluble form. If our farmers would take more pains with their calves to give them a good start, and when they are fleshy, fat, and growing well, resist the temptation to take them to market for veal, but see them well through the first season, they will find that the bullocks and heifers thus raised will make the very best and cheapest beef to raise, fit for the shambles the second year—though better the third—with nothing but hay and grass after the first year.

Repeated trials in our own country show the folly of selling calves, and the decided advantage and profit of raising good stock and keeping it till the second or third winter. While we would not advocate a deficiency of food for calves, we would as strenuously argue against an over-supply, especially of stimulating food.

The Scotch plan of raising calves, more particularly for the dairy, would, perhaps, be more in accordance with our customs and notions; which is, to commence with new milk, and gradually substitute skimmed milk, with a little oat or barley meal, and finally get them entirely on to gruel. The cost of a calf in ordinary times would be something as follows:

84 quarts of new milk for a fortnight, at 2 cents	$1 68
700 quarts skimmed milk for ten weeks, at 1 cent	7 00
Pasture five months	2 00
Hay, first winter, at $10 per ton	5 32
Roots and meal	4 00
	20 00

This would make the creature cost, at a year old, $20. Now, add to that pasturing the second summer, say $5, and the second winter's keeping of hay

$4, and four bushels of meal and roots, $4 more, making the whole cost of the steer $33. Now, if the steer is turned early from good grass, his whole cost would not be over $38 or $40; and being between two and three years old, should fetch some $60 or $70.

A very intelligent writer in Ohio says: "It is bad economy to sell animals at a younger age than two years, as the market price is much below their true value. For example, a fat calf weighing one hundred pounds gross will make eighty pounds salable product, hide and flesh, and ought, therefore, as the meat retails as high as beef, to sell for a third more per pound live weight than a matured animal; but the fact is, they usually sell for less.

"The cost of producing a yearling steer, making a proper allowance for the expense in part of keeping the cow, cannot be less than $15, and is probably $20, and ought to be to have a good one, while the market price for such a steer will not be much over $10. But such a steer will, during the next eighteen months, with liberal feeding one winter and good grazing two summers, be made to weigh 1,200 pounds, and will fetch from $45 to $55, which another year will bring the price from $75 to $85."

A very satisfactory and economical way of raising calves, without materially interfering with the butter-making, is to take the calves when three days old, or as soon as the milk becomes fit for use, from the cows, and put them in a stable by themselves out of sight or sound of their dams; feed them with gruel, composed of one-third barley and two-thirds oats, ground together very fine, sifting the mixture. The gruel is made as follows: to one quart of the flour add twelve quarts of water, boil the mixture half an hour, and let it stand until milk-warm. Each calf is to receive at first a quart of the gruel morning and evening. In ten days tie up a bundle of soft hay in the middle of the stable, which they will learn to eat by degrees. A little of the flour put into a small trough for them to lick occasionally may be of service. Feed them thus until they are two months old, increasing the quantity. Three bushels of the above mixture will raise six calves.

Another recommended plan is to take the calf away at two or three days old, teach it to drink at once, and give it new milk for about a fortnight, gradually mixing in that which has been skimmed, till the new milk is entirely dispensed with, and with the skimmed milk an equal or larger portion of thin flax-seed jelly is mixed, and the whole given milk-warm.

Thus again, as spring advances, the farmer is enabled, during the two months the calves are kept previous to weaning, to make as much butter as they are worth, besides having a calf that, well started, will in two years fetch some $75.

In the rearing of calves very much depends on the regularity of feeding them; the common practice being to give them their food but twice a day, when they generally receive as much as their stomachs will hold; the digestive organs are thus frequently impaired, and the animal becomes stunted or diseased. Whatever food be allowed to young calves, care should be taken that it be not changed too suddenly. A calf must have attained a certain degree of strength before it can dispense with the food most natural to its age, and thrive without the aid of milk. It should, therefore, be continued as long as possible; but even when that has been withdrawn, and the animal has begun to eat grass, still the substitutes that had been employed in lieu of milk should be partly continued till his appetite prefers the pasture, and while he is in a growing, thriving condition.

Farmers do not figure like merchants; if they did, they would find that a large portion of the calves now dropped had, for profit, better be knocked in the head at once than made into veal—the amount of milk consumed being in value much more than they get for their calves.

On the other hand, if they will take the pains to raise good stock by some one of these economic plans, by which they can have a fine animal and save

their milk for butter or cheese, and carry through to the second or third year, it will most certainly be found to pay a handsome profit. To do this with success, however, attention should be paid to the character of the dam and the sire.

If the farmer's cows are, as is generally the case through the country, what would be called native, mixed grades, made up, very likely, for a good lot of milkers, let him have the services of a pure-bred bull, and his calves will have from their sire those qualities which make early maturity, large size, tendency to fatten, and first quality of meat.

Probably, for the raising of good steers, the short-horn or Hereford would be preferred as giving greater size and early maturity, though the Devon would have its advocates; for the dairy the Ayrshire stands first.

To illustrate the advantages of good blood and the profitable results of high feeding, the statement below of the cost and return of a fat ox is taken from "The Country Gentleman:"

"He was a grade short-horn, small boned, light of offal, and sprightly.

Age.	Cost to date.	Feed.	Live weight.
6 days	$4 00		84
6 months	10 00	Milk and grass	555
1 year	29 00	Hay, potatoes, and provender	820
1½ year	39 00	Grass	1,070
2 years	59 00	Hay and two quarts provender	1,360
2½ years	72 00	Pasture only	1,550
3 years	94 00	Hay and three quarts provender	1,735
3½ years	108 00	Pasture only	2,005
4 years	136 00	Four quarts meal and hay	2,215
4½ years	166 00	Meal and hay	2,365
5 years	198 00	Five quarts meal and hay	2,570
5½ years	233 00	Six quarts meal and hay	2,710
6 years	274 00	Eight quarts meal and hay	2,815
6 years and 10 months	339 00	Twelve quarts meal and hay	2,840

"He was slaughtered at this last-mentioned age, and the weight 2,840 was after a fast from food and water of forty hours; he was sold for $325, nearly 11½ cents live weight. His dressed weight was—beef, 2,209 pounds; tallow, 190 pounds; hide, 130 pounds; total, 2,529 pounds. He was fed too long for profit. At the age of three or four years he could have been sold at a fine profit, while the result seems to have been a small loss on the cost."

This statement illustrates the superiority of those well-bred animals which carry their growth with their constitution and excel in early maturity—a matter perfectly easy of accomplishment by every farmer who has intelligence enough to distinguish between a good and a poor bullock.

This statement also shows the very important fact that, in producing beef, a large part of the profit comes from grazing. Undoubtedly this steer was stabled in the winter and fed on hay, ground feed, and, perhaps, roots, so as to produce the most rapid and economical increase in weight; and yet it will be observed that the increase of the animal on grass in proportion to the expense is much the best.

The renovation and improvement of pasture lands is one of the most important questions before the farmers of the present day, for from them comes the profit of feeding—from the stables comes the manure.

Calves should be dropped as early as April, or before, as later calves are not so profitable, especially if it is intended to raise them for steers. The calf ought, in fact, to be old enough to eat a little grass by the tenth day of May so as to give it the benefit of the whole grass season.

With such management as we have described, a steer calf will be worth, at

a year old, three times as much as the average of the calves raised according to the system usually practiced. Common calves at this age usually can be had for five or six dollars—the milk they have consumed would amount to more than that—while steers of good blood, and kept in any of the ways recommended, will sell readily for $20 to $25. The difference in value will be nearly three times the difference in the expense. In the one case, the amount expended is a clear loss; in the other, it yields a large profit. An animal well carried through the first year with abundance of good nourishing food, and grain enough to keep him constantly gaining, can be kept fat enough to kill, and that, too, without meal afterwards.

A common steer, weighing 1,200 pounds live weight, will scarcely make 600 pounds of beef, while a steer of good blood and in ripe condition, weighing 1,700 pounds, will produce 1,000 pounds of meat. There is this striking difference between an ordinary and a well-bred bullock—in the per cent. of dead weight as compared with the gross weight, in addition to the superior quality of the flesh, in favor of the well-bred and well-fed steer.

In these modes of feeding it will be observed that the great object in view is the raising of cattle without interfering with the products of the dairy. That this is desirable will be seen at once when we estimate the amount of milk necessarily consumed by a calf which is fed from the cow until old enough to subsist on solid food.

In those sections of the country where butter and cheese are manufactured each cow has been estimated in ordinary times to make an annual return of from thirty to sixty dollars; when milk is sold directly from the farm to consumers in our large cities the return is much larger.

It is, therefore, only in the remotest regions, far from a market, that the plan of allowing calves to run with the cow for months can be practiced with any profit, unless it be with breeders of pure-blooded stock commanding high prices in the market.

In those sections where beef-raising and feeding are profitable, it is undoubtedly best to force the young animal to maturity; but this should be done with all the economy consistent with the purpose. For the breeders of animals of this description, those which never falter in their growth, and arrive early at perfection, are the most desirable. Such animals as these may possibly remunerate the breeder for a somewhat liberal use of milk in feeding But in the raising of dairy stock, or those classes of cattle which are not developed properly for feeding until two or three years old, some substitute must be found, and we have endeavored to show some of the different modes best adapted for this purpose.

The fact, as before stated, that in 1864 over seventy-six thousand veal calves were slaughtered in the New York market alone, is a sufficient reason for having dwelt somewhat particularly on the importance of saving and raising more calves, and especially of rearing them in such a manner, and with such food, as should not interfere with the products of the dairy, and yet should supply to the animals all the elements contained in their natural food, and which, judiciously used, shall contribute to a rapid, vigorous, healthy growth, such as is essential to early maturity in the bullock, a condition necessary to profitable feeding.

We shall next, after some preliminary suggestions as to the consumption of animal and vegetable food, with the analysis of some, proceed to develop somewhat, by argument and by illustrations of feeding at home and abroad, the second of the considerations proposed to remedy the deficiency in the supply of beef and mutton—of making more and better meat on the animals we have, by a judicious use of various articles of food, especially roots, based on scientific principles and proved by practical demonstrations.

That meat is supplied to us chiefly from the ox, the sheep, and the pig, we

are all aware, and also that every part of these animals is converted by us to some highly useful purpose. But we are not so generally aware of the proportions which the butcher finds of these in different animals. Mr. J. B. Lawes, of Rothampstead, England, the distinguished farmer, chemist, and writer, reported in 1860, in the Royal Society's Journal, the result of some most interesting and extensive experiments upon the mean actual weights of some of the domestic animals. His purpose was to ascertain the effect of food, the composition of flesh, and all the relations between food and flesh. To acquire the necessary data relating to this subject, some hundreds of animals, oxen, sheep, and pigs, were supplied for many weeks or months consecutively with given quantities of food of known composition, and the weights of the animals themselves were also taken, both at the beginning and the end of the experiments; and some of the animals were also slaughtered and carefully weighed separately, and the increase of different parts of the body carefully noted, with the different conditions attendant on each experiment. So that, on the whole, this constituted the most perfect series of experiments ever tried, of this class, requiring an immense deal of labor, care, and patience, and no little capital.

The first table will be found very interesting, as showing the proportions of the different organs and parts of the bodies of oxen, sheep, and pigs.

Table of mean actual weights, pounds and ounces, of the entire bodies and the different organs and parts of different descriptions of animals.

Description of parts.	16 heifers and bullocks.	249 sheep.	59 pigs.
"Offal."	*lbs. oz.*	*lbs. oz.*	*lbs. oz.*
Stomachs	35 13.9	3 12.3	2 10.4
Contents of stomach and vomit	92 12.8	7 10.4	
Caul fat	23 2.9	7 1.8	1 2.3
Small intestines and contents	17 12.0	2 7.6	4 8.4
Large intestines and contents	13 7.0	2 15.2	8 5.7
Intestinal fat	26 5.4	3 2.2	2 5.6
Heart and aorta	5 10.6	10.4	9.6
Heart fat	3 3.8	7.8	....
Lungs and windpipe	9 3.6	1 8.3	1 9.1
Blood	45 12.8	6 1.6	7 10.1
Liver	14 13.3	2 5.4	3 4.5
Gall bladder and contents	15.7	1.5	2.1
Pancreas—"Sweet bread"	1 1.0	3.3	6.6
Thymus gland—"Heart bread"	10.7	....	....
Glands about the throat—"Throat bread"	5.5	....	....
Milt or spleen	1 13.9	4.0	4.7
Bladder	9.1	0.8	2.5
Penis	....	....	7.1
Brains	12.0	....	....
Tongue and head	30 10.7	4 8.1	1 0.2
Hide or skin and wool	84 9.5	13 0.4	....
Feet and hoofs	20 0.6	....	2.9
Tail	1 1.9	....	....
Diaphragm or skirts	5 2.0	3.4	....
Miscellaneous trimmings	3 15.3	3.0	8.8
Total offal parts	439 14.0	61 11.5	35 4.6
Carcass	680 12.0	91 12.5	176 5.3
Loss by evaporation, errors in weighing, &c	20 7.1	2.2	1 2.1
Aggregate	1,141 1.1	153 10.2	212 12.0

The next tables give the percentage of dry substance and water in the carcasses and in the offal, respectively, of ten animals of different descriptions, or in different conditions of growth and fatness.

Description of animals.	PERCENTAGE OF CARCASSES.		PERCENTAGE OF OFFAL.	
	Dry substance.	Water.	Dry substance.	Water.
Fat calf	37.7	62.3	35.1	64.9
Half-fat ox	46.0	54.0	40.4	59.6
Fat ox	54.4	45.6	47.2	52.8
Fat lamb	51.4	48.6	41.5	58.5
Store sheep	42.7	57.3	36.3	63.7
Half-fat old sheep	50.3	49.7	38.9	67.1
Fat sheep	60.3	39.7	44.8	55.2
Extra-fat sheep	67.0	33.0	54.9	45.1
Store pig	44.7	55.3	32.1	67.9
Fat pig	61.4	38.6	40.6	59.4
Means of all	51.6	48.4	41.2	58.8

These tables are of great importance and interest. The animals were weighed fasting just before being slaughtered, and as soon afterwards as possible, to determine the weight of carcass, of each of the internal organs, and of some other separate parts.

A few words may be offered, directing attention to the more prominent points of distinction between the different descriptions of animals, oxen, sheep, and pigs, in regard to the amount and the proportion in the whole body of their respective organs and parts.

The proportion of the stomachs and their contents constitute in the oxen about 11½, in the sheep about 7½, and in the pig only about 1¼ per cent. of the entire weight of the body. The proportions of the intestines and their contents stand in the opposite relation.

Thus, they amounted to about 6¼ per cent. in the pig, about 3½ per cent. in the sheep, and to only about 2¾ per cent. in the oxen. These distinctions are perfectly intelligible when taken in connexion with the fact that in the food of oxen and sheep there is so large a portion of indigestible woody fibre, and in that of the well-fed pig so much less, and at the same time a comparatively large proportion of *starch*, the primary transformations of which are supposed to take place chiefly after leaving the stomach, and more or less throughout the intestinal canal.

Taking together stomachs, small intestines, large intestines, and their respective contents, the entire bodies of the oxen yielded an average of rather more than 14 per cent., of the sheep a little more than 11 per cent., and of the pigs about 7½ per cent.

Another interesting branch of this inquiry is the relative development of the several organs and parts as the animal progresses in maturity and fatness.

The experiments showed that the internal organs and other "offal" parts pretty generally increase in actual weight as the animal passes from the store or lean to the fat, or to the very fat condition; but that, excluding the loose fat, which increases not only in actual weight but proportionally, their percentage proportion in the whole body as invariably diminishes as the animal matures and fattens.

The carcasses, on the other hand, invariably increase both in actual and percentage amount as the animals mature.

The above remarks apply generally to oxen, sheep and pigs, but the data relating to the sheep comprise the most pointed illustration.

The average actual weight per head of the collective stomachs and intestines and their contents increased from about $13\frac{3}{4}$ pounds each in *lean* or *store* sheep, to about $15\frac{3}{4}$ pounds in fat sheep, and to about $16\frac{1}{4}$ pounds among *very fat* ones. Again, the heart and aorta, the lungs and windpipe, the liver, gall-bladder and contents, the pancreas, (sweet-bread,) the milt or spleen, and the blood, all taken together, give an average actual weight per head, for each *store* sheep, of $7\frac{3}{4}$ pounds, for each of the hundred *fat* ones of $11\frac{3}{4}$, and for the *very fat* ones of $12\frac{1}{2}$ pounds each. Of the internal parts, the loose fat alone increases in both actual weight and percentage proportion with the progress of the animals. It averages in *actual weight*, for the lean or store sheep, about $4\frac{1}{4}$ pounds, for the fat ones about $8\frac{3}{4}$ pounds, and for the very fat ones about $14\frac{1}{2}$ pounds. In *percentage proportion* it averages for the lean sheep 4.52, for the fat ones 6.03, and for the very fat ones 7.44.

The results, as regards the *total* offal parts, and the total carcass parts, respectively, are as follows: The total offal parts increased in average actual weights per head, from $42\frac{3}{4}$ pounds in the *lean* or *store* condition, to $58\frac{3}{4}$ pounds in the *fat*, and to $68\frac{3}{4}$ in the *very fat.*

The increase in actual weight of the corresponding carcasses was much greater, namely, from $49\frac{3}{4}$ pounds in the *store*, to 85 pounds in the *fat*, and to nearly 123 pounds in the *very fat* condition.

The result is, then, that, although the collective internal organs and other offal parts increase considerably as the animals fatten, the carcass or frame, with its muscles, membranes, vessels and fat, increases very much more rapidly.

It follows, from the data involved, that of the *increase* from the lean to the fat condition, 68.8 per cent., and of the increase from the fat to the very fat condition, 79.8 per cent., would be salable carcass.

It may, perhaps, be estimated that 65 to 70 per cent. of the gross increase of oxen and sheep liberally fattening over a considerable period of time will be salable carcass.

Calculations of a similar kind in regard to pigs show that of their increase during the last two or three months of liberal feeding, little less than 90 per cent. may be reckoned as salable carcass.

That the character of the fattening food, even within the period of only a few weeks, has a marked influence upon the character of the development, and consequently upon that of the meat produced, is shown by a careful consideration of the various experiments, the general result being that when the proportion of non-nitrogenous to nitrogenous substance in the food was comparatively high, the proportion of carcass, in the live weight, was also comparatively high; and the carcasses themselves, at the same time, comprised a larger proportion of the fat and a less one of the lean parts. There cannot be a doubt that those animals which yielded the largest proportion of carcass, and whose carcasses consisted in the larger proportion of the fat parts, would be most valued by the consumer, and for which the feeder would get the highest price.

In connexion with the question of the influence of food, and the character of development of the animal upon the character and value of the meat produced, it may here be proper to state that, in the case of some of the sheep that were fed experimentally upon different food, joints from selected animals were roasted, and the weights of the cooked meat, the dripping, and the loss by evaporation determined. The result was, that both the leg and the loin of a sheep that had been fattened upon *steeped* barley and mangolds, and which gave a very rapid increase, gave several per cent. less cooked meat, and lost more, both of fat in the form of dripping and of water, than the corresponding joints of a sheep which had been fed upon dry barley and mangolds, and which gave only about half the amount of gross increase within the same period of time.

Attention has been called to the fact that, taking only the price of *food* and the value of the manure into consideration, it would be for the interest of the farmer to employ the more highly nitrogenous food pretty liberally.

It was shown, on the other hand, that when the proportion of nitrogenous to non-nitrogenous food exceeded a stated amount, the proportion of increase in live weight obtained for a given amount of food was either less or but very little greater. It is now further seen that, with an excessive proportion of nitrogenous substance in the food, the proportion of carcass was less, and of the more valued fat parts was also less. The mean conclusions from these experiments may be stated as follows:

Fattening-oxen, fed liberally upon good food, composed of a moderate proportion of oil-meal or corn, some hay or chopped straw, with roots, or other succulent food, and well managed, will, on the average, consume twelve to thirteen pounds, dry substance, of such mixed food, per 100 pounds, live weight, per week, and should give one pound of increase for twelve to thirteen pounds dry substance so consumed.

Sheep fattening under somewhat similar circumstances, but with a less proportion of hay or straw, will consume about fifteen pounds of the dry substance of the mixed food per 100 pounds, live weight, and should yield, for a considerable period of time, one part of increase in live weight for about nine parts of the dry substance of their food.

If the food be of good quality, oxen and sheep may give a maximum amount of increase for a given amount of total dry substance of food, even provided it contains as much as five parts of total non-nitrogenous to one of nitrogenous compound.

Pigs fed liberally upon food composed chiefly of grain will consume from 26 to 30 pounds per 100 pounds, live weight, per week, of the dry substance of such food. They should yield one part in increase in live weight for from four to five parts of the dry substance of the food. They may give a maximum amount of increase for a given amount of dry substance of such food, if it contain as many as five or even six parts of total non-nitrogenous to one of nitrogenous compound.

The cereal grains contain, on the average, rather more than six parts of total non-nitrogenous to one of nitrogenous compound, and the leguminous seeds often not much more than two parts to one.

Oil-meal and grain contain rather more than six-sevenths, and hay, &c., rather less than six-sevenths of their weight of "dry substance." Common turnips generally contain about one-twelfth; Swedes, about one-ninth; mangolds, about one-eighth; and potatoes about one-fourth of their weight of dry substance. With as many as five or six parts of total non-nitrogenous to one of nitrogenous compound in the dry substance of the fattening food of oxen, sheep, and pigs, the increase will probably be very fast. In the earlier stages of growth and feeding a more proportional part of non-nitrogenous to nitrogenous compounds is desirable.

Taking into consideration the cost of the food and the higher value of the manure from that which is rich in nitrogen, it is frequently the most profitable for the farmer to employ, even up to the end of the feeding process, a higher proportion of nitrogenous constituents in his stock food than is necessary to yield the maximum proportion of increase in live weight for a given amount of dry substance of food.

In proportion to their weight, oxen contain considerably more of stomach and contents than sheep, and sheep more than pigs. Pigs have considerably more intestines and contents than sheep, and sheep more than oxen. All have nearly equal portions of the other organs. In proportion to their weight, sheep yield rather more loose fat than oxen, and pigs much less than either.

As oxen, sheep, and pigs mature and fatten, the internal organs increase in

actual weight, but they diminish in proportion to the weight of the animal; the internal loose fat increases both in proportion and actual weight; the total offal increases in actual weight, but diminishes in proportion to the weight of the body. Moderately fattened oxen should yield 58 to 60 per cent. carcass in fasted live weight; excessively fat oxen may yield from 65 to 70 per cent.

Moderately fattened sheep (shorn) should yield about 58 per cent. carcass in fasted live weight; excessively fat sheep may yield 64 per cent. Moderately fat pigs should yield about 80 to 82 per cent. carcass in fasted live weight, and very fat ones still more. The proportions in all vary much according to breed, age, and condition of the animals.

The experiments of M. Reisert, a French gentleman, scientific farmer, and chemist, owning a large farm near Dieppe, in France, published in the "Annales de Chemie," were conducted with great care, and show similar results to those we have quoted. One of his experiments was made for the special purpose of testing the quantity of nitrogen recovered in the carcass and in the manure, so that the waste by the breath, &c., might be arrived at. Five sheep were selected and weighed, of which two were slaughtered at once, to determine the proportions of meat, wool, and offal, &c., at the starting point. The three survivors were put into a stall so floored that all the excrements could be preserved together. The food was steamed mangolds, bran, and oats. At first the animals lost their appetite, so that on the fifth day the three only ate 3¾ pounds of pulp and 1¾ pounds of oats, and consequently lost weight rapidly. Something was clearly amiss; accident pointed out a remedy; for the sheep, when taken, after forty-one days, to the weighing-bridge, rushed forward greedily to devour some long straw which lay in the way. The hint was taken, but the straw supplied was cut into chaff and placed in the manger, that the investigation of the manure might not be impeded. This first essay, under difficulties, may be considered useful only as bringing out the worth of straw as a stay to the stomach, or ballast, (as M. Boussingault calls it,) and the excess of nitrogen in the secretives, which any derangement in health occasions. The whole trial was divided into four periods: the first, of forty-one days, (as mentioned,) represents failure; the second, thirty-two days, the rally; the third, seventy-two days, continuous progress; the fourth, eighteen days in May gave a hint to conclude.

In the third period the course of events was uniform and steady; it therefore offers the surest basis for general conclusions.

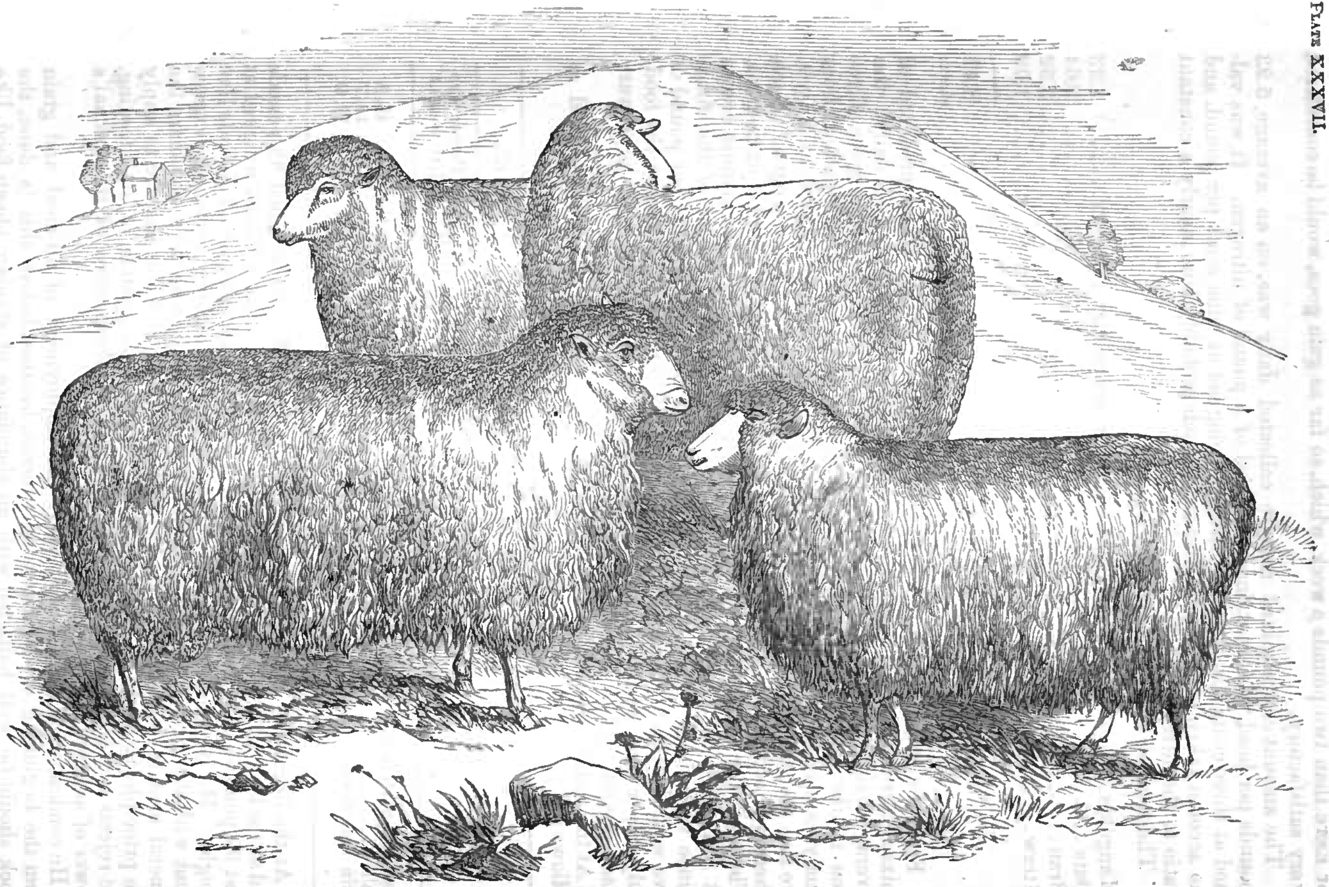
The two sheep weighed when put up, respectively, 88 and 99 pounds. They ate regularly, per day, of steamed mangolds, at first, 9 pounds, but soon 11 pounds; bran, 2.2 pounds; oats, 2.2 pounds; of chopped straw a ration, which decreased from 1¾ to 1 pound, as the weather grew warmer. The average of food taken per day was—

Mangolds, steamed	5.36	pounds.
Oats	1.10	do.
Bran	1.08	do.
Straw	.58	do.
In all	8.12	

The increase in live weight, ascertained every week, was steady; they never went back. In some weeks there was an *apparent* gain of 4 pounds per head. The entire gain in live weight amounted—

In one sheep to	24.2
In the other to	17.6
	41.8
Average	20.9

PLATE XXXVII.



COTSWOLDS

or more than two pounds a week, which, so far as gain goes, would be considered very satisfactory.

The amount of the mixed manure collected daily was, on an average, 5.23 pounds per head, and contained one-third of a pound of nitrogen. It was valued at three cents per day, the nitrogen being set at nine cents per pound, and no account taken of other constituents, which probably bore nearly a constant ratio to the nitrogen.

The total of the food consumed was—

Mangolds.................	772.8	pounds,	containing	nitrogen......	1.23
Oats.....................	159.5	"	"	"	2.64
Bran.....................	145.2	"	"	"	3.52
Straw....................	84.6	"	"	"	1.02
	1, 162.1				8.41

From the 22d of February to the 4th of May, the two sheep produced of mixed excrement 753 pounds, or, on an average, 5.23 pounds each daily; the average weight of food was 8.12 pounds per head. If, in calculating the nitrogen in the excrement, we take the mean of .635 per cent., deducted from analyses made from February 15 to February 21, and from May 5 to May 9, we find that these excrements ought to contain 4.78 pounds nitrogen. Each sheep voided, therefore, in twenty-four hours one-third of a pound of excrement. The cost of the keep was estimated at $5 50. The value of the manure comes at the price to $1, or about twenty-one per cent. of the cost of the food. Since the increase was 41.8 pounds, the cost of feeding is 7 cents per pound of live weight gained. It thus appears that of the nitrogen contained in the food, only 56 per cent. was recovered in the manure, and that the value of the manure was *one-fifth* that of the food.

At the conclusion of the experiment, May 21, the two sheep were killed as follows:

	No. 60.		No. 67.	
	Weight.	Percentage live weight.	Weight.	Percentage live weight.
The four quarters....................	56.3	43.4	59.	45.5
Tallow....................	12.5	9.6	19.	14.7
Skin and fleece....................	17.6	13.5	14.5	11.2

At the beginning of the experiment in December, No. 60 weighed 88 pounds and at the last, 130 pounds—an increase of nearly 42 pounds. No. 67 weighed at first 99 pounds, and at last 130 pounds, showing an increase of 31 pounds live weight. M. Reiset does not pretend to be able to combine a scientific experiment with the greatest economy of production; but since he does not share the general mistrust entertained for scientific results, he did not hesitate to apply the principles deduced from these trials to his general system of stall-feeding. He rejects a forcing system of feeding which is irrespective of the animal's power of assimilation.

He condemns as useless and costly the employment of oil-meal and grain from the beginning of the fattening process, because, before this is done, the stock should be well ballasted with an abundance of *staying*, cheap food, like straw, hay, fodder, &c. Mangolds will bring in cattle and sheep both, so that a very little grain will complete the fattening process.

That the practice of agriculture is influenced by extraneous circumstances to

a greater extent than that of any other art is a position too obvious to admit of any question. Daily experience shows us that the best-grounded hopes of the farmer are liable to be destroyed by the vicissitudes of the weather, and a hundred other causes which it is impossible to foresee or guard against. And hence in all ages the art of agriculture has been stamped with the character of uncertainty. But while this is strictly true as a general statement, we have only to examine the nature of farming operations as carried on at the present day, to see that it does not apply with equal force to all its different departments. In fact the practice of agriculture embraces two very distinct subdivisions—the cultivation of the soil and feeding of cattle; and of these, the former, under the old system of agriculture, enjoyed a special pre-eminence, while the latter was looked upon as subordinate to it.

If we keep this subdivision prominently before us, we cannot fail to perceive that it is to the cultivation of the soil that the character of *uncertainty* more peculiarly belongs; and the feeding of stock as now practiced is, in certain points of view, less uncertain, and more easily brought within rule, than the cultivation of our crops.

We take the cattle which we propose to fatten, place them in well-constructed buildings, in which an equable temperature is maintained; by the exclusion of light, and confinement in a narrow space, we prevent them from expending in muscular action the food that ought to be converted into flesh and fat; and finally, we supply them with the kinds and quantities of food which are best suited to fulfil the objects we have in view; so that if our cattle are healthy and escape the ravages of epidemic disease, we ought to reduce the process of feeding to one of comparative certainty.

To insure all this, however, we must first have established the principles involved in the fattening of cattle, and have ascertained the exact nature and composition of the different sorts of food with which we supply them. It cannot certainly be asserted that all this has been effected; but a comparison of the practice of feeding, forty or even twenty years since, with that employed by the most skilful farmers of the present day, affords abundant evidence that in no department of agriculture have more rapid strides been made.

Science and practice have combined to produce this effect: the former by the analysis of various substances employed as food; the latter by careful experiments, often of a very elaborate nature, on the fattening effect of different nutritive matters of known composition.

Numerous, however, as these experiments have been, the subject is far from being exhausted. It is not by a single, or even by a few experiments, that we can hope to establish in a definite manner all that we require to know; an immense mass of facts must be accumulated, our observations varied in every point of view, and great caution must be exercised in drawing our conclusions. Prominent among the articles used in fattening stock, as artificial food, is linseed cake, or oil-meal, now very largely used in Great Britain, and to some extent in this country, though not nearly to the extent it ought to reach. Our farmers ought to raise more flax both for spinning and for the seed for feeding. A proper proportion of this with turnips would, beyond all doubt, make a valuable and economical change with Indian corn in the fattening of our cattle. In judging of the proportions of these various articles of food, and how they should be given, it is first important to know the chemical composition of them, and preparatory to that there are a few observations on the nature of the constituents of linseed oil-meal, or cake, and of the food of animals in general.

It must be remembered that the chemical constituents of all food belong to two great classes—the nitrogenous and the non-nitrogenous. The former embraces a variety of substances known under the name of gluten, vegetable fibrine, caseine &c., &c., all similar, if not identical, in composition, though characterized by proportions which enable us to readily distinguish them from one another

These substances are not only similar to one another in composition, but they appear to be identical with the nitrogenous constituents of animals. It is in these forms that the whole of the nitrogen is supplied to the animals, and hence their peculiarly nutritive function is to promote the formation of muscular flesh. The non-nitrogenous constituents of food are divisible into two, or more correctly into three, sections. Of these, the first embraces the fatty matters, to which the exclusive power of producing fat was at one time attributed. Late researches, while in no degree diminishing the importance of that great class of organic compounds in promoting the accumulation of fat, has shown that the other subdivision of the starchy or saccharine substances is scarcely, if at all, inferior to the fatty matters in this point of view. It has, in fact, been satisfactorily established that sugar, starch, and gum are capable of replacing the fatty matters in producing fat, although it is not probable that they do this to any great extent if a sufficient quantity of the latter exist ready formed in the food. Yet these saccharine matters are essential to all highly nutritive food, because, along with the oleaginous substances, they may serve to sustain animal heat, and may be looked upon as the prime mover of the animal machine. But no food supplied to cattle consists exclusively of the three great classes of constituents already named. There is present in all a certain proportion—most abundant in stems, least so in the seeds—of a substance destined to confer rigidity upon the plant and to give support to its various organs, and which, under the name of woody fibre, is familiar to us as the main constituent of the trunks of trees. This substance, allied in constitution to the starchy matters, is yet distinguished from them by its extreme insolubility, which prevents its acting as nutritive substance. Its presence, therefore, in any food, necessarily diminishes its value, and it does so not merely by reducing the quantity of really valuable matter, but likewise by forming an insoluble envelope which protects them actually from the solvent forces of the stomach.

If we take into consideration the fact just stated, it must be obvious that, to obtain a complete idea of the nutritive value of any food, it is necessary, separately, to determine the proportion of nitrogenous, starchy or saccharine, fatty, and mineral matters. It is not necessary for practical purposes, however interesting it might be in other points of view, to establish the proportion of the individual constituents of each group. Thus, supposing any sort of food to contain both starch and sugar, a determination of the quantities of each is not required, provided we know the sum of the two, for we may consider it certain that these substances, having the same nutritive functions, may replace one another. Nor is it necessary or desirable that experiments should be made by the farmer; it is the business of the chemist in his laboratory to work out these details, to give the various constituents of the different articles of food and their proportions, to show what elements go specially to the growth, what to the flesh, and what to the fat of the animal; it is then the business of the practical farmer, taking into consideration the other surrounding circumstances, to apply the information obtained from the chemist in such a way as to yield the largest profit. Thus, we see how science is subservient and auxiliary to the art and practice of agriculture, and how beautifully and harmoniously they work together.

Directly in this connexion, too, is another most important fact, or series of facts, which, without the aid of science, would remain unknown, or at least uncertain, and that is the value, absolute and relative, of the various articles of food, as producing the manure so necessary to the farm. "No cattle, no manure; no manure, no corn; no corn, no cattle."

The science of chemistry not only shows the farmer why corn is better for feeding than straw, and why the manure from corn is better than that from straw, but it also shows him the different relative values of food, in money, for making manure.

I propose to give a few brief analyses of some of the different articles mo used for feeding, taken from the reports of Professor Anderson, of Scotlan Voelcker, Lawes, Way, and Gilbert, of England, Liebig and others, of the co tinent, commencing with

TWO SAMPLES OF LINSEED-OIL MEAL OF BRITISH MANUFACTURE.

	No. 1.	No. 2.
Water	11.87	10.
Oil	10.08	10.
Albuminous compounds	26.04	28.
Saccharine and mucilaginous compounds	41.90	36.
Fibre	4.24	8.
Ash	5.87	5.
	100.00	100.
Nitrogen	4.14	4.
The ash contains earthy phosphates	3.13	3.
Phosphoric acid combined with alkalies	.31	.

TWO SAMPLES OF AMERICAN LINSEED-OIL MEAL.

Water	8.70	9.
Oil	13.17	15.
Albuminous compounds	30.94	28.
Mucilaginous and saccharine matter	37.54	35.
Fibre	4.48	5.
Ash	5.17	5.
	100.00	100.
Nitrogen	4.92	4
The ash contains earthy phosphates	2.93	2
Phosphoric acid combined with alkalies	.23	

Although we find that when an average is taken, all oil-meal is toleral similar, matters are altered when individual samples are compared, for then differences become very material. Comparing, for instance, some samples meal, it was found that the oil varied from 9.5 to 16.17 per cent.—that is to s by nearly 30 per cent. of the whole; and similarly the albuminous compou fluctuate between 26 and 31 per cent. As a general rule, the higher the oil, lower the albuminous matters; but frequent exceptions are found, as some m is remarkably rich in both.

The estimation, however, of the feeding value of the different samples i matter attended with some degree of difficulty, and must turn upon the p whether the oily or the albuminous compounds are most important in promot the growth and fattening of cattle. At one time it was held that the la deserved the preference, and that they might be correctly taken as the meas of the value of any sort of food. We now know that this is not absolutely rect, for it has been distinctly recognized that a proper proportion must sub between the different classes of nutritive matters; so that if we had a food taining abundance of albuminous matter, it would be of inferior value unle proper quantity of oily and saccharine matter was also present.

In estimating the value of linseed meal it appears that we must take consideration both substances, but that the greatest weight is to be attache the albuminous compounds. The value of linseed cake or meal is estim

commercially very much by its external characters, such as color, taste, hardness, and uniformity of appearance; and these characteristics are not to be undervalued, for they are excellent indications of the condition of the seed from which the meal has been manufactured, and it is manifest that a preference is to be given to that produced from clean and well-harvested seed; but an implicit and exclusive reliance on these indications alone must frequently lead to most fallacious results, and cause really valuable samples to be undervalued, and some to be selected in preference, of much less real worth to the feeder.

In another part of this article we allude more fully to the fact that it is not merely for laying on fat that oil-meal is used. It is only by the increased value of the manure from the nitrogenous properties of the meal that either the English or American farmer can afford to use it. In the western portion of this country, where manure is less needed, oil-meal is little used.

One of the most valuable of all artificial foods is cotton-seed meal, of which there are two kinds that have been used, the difference arising from the manner in which they are prepared. The one called the decorticated meal is made from the kernel alone of the seed, the husk or hull having been stripped off by machinery before grinding; the other is made of the whole seed. The difference in the composition of the two is very great; the decorticated meal contains sixteen per cent. of oil—more than any other description of meal—while the whole-seed meal contains only six per cent. The proportion of albuminous or flesh-forming matter in the decorticated meal amounts to forty-one per cent.; in the whole-seed meal it is only twenty-three per cent.—about one-half. So with respect to the other constituents; the proportion of woody fibre is much larger in the whole-seed meal than in the other. The husk in the whole-seed meal was for a long time a great impediment to the general use to which cotton-seed meal ought to come, and probably will come, in this country. It is richer than meal from linseed, and obtainable at a much less rate. The difference between the kinds of meal is so great that probably one ton of the decorticated meal will go as far as two tons of the whole-seed meal. There is, besides, much danger in using the whole-seed meal; and some manufacturers have been so unscrupulous as to sell the one for the other. We have known several instances where valuable animals, particularly calves and lambs, were killed by the use of the whole-seed meal; and this has sometimes given rise to the idea that cotton-seed meal was poisonous. Nothing could be more erroneous. There is nothing poisonous in the husk of the cotton-seed, and when given judiciously no injury will result; but if animals are supplied with an unlimited quantity of dry food with the whole-seed there is danger. The hard husk is indigestible, and sometimes rolls together in such large masses that inflammation of the bowels ensues. There is no such danger, however, in the use of the decorticated meal. Decorticated meal is of different qualities, and care should be taken to buy only the best quality, and of the most reliable parties, for not only the composition but also the condition of the meal in a greater degree determines the measure of its value.

The Union Oil Company of Providence, Rhode Island, previous to the war, decorticated the seed, expressed the oil, and ground the meal, furnishing it at a very reasonable price. Whether they continue since the war we are not informed. They were reliable, and the meal from their mill was free from husk, and rich and fattening in quality.

The condition of cotton-meal is very much determined by its color—when fresh, being as yellow as mustard; and recent analyses have shown that it has been shamefully adulterated with mustard and other seeds, to the great injury of sheep and cattle fed on it in England. If it is kept in a damp place it rapidly deteriorates both in color and condition.

The following table was prepared some years since by Professor Voelcker, then of the Royal Agricultural College, Cirencester.

Composition of cotton-seed oil meal.

	Decorticated.	Wh
Water	8.29	11.
Oil	16.05	6.
Albuminous compounds, (flesh-forming matter,)	41.25	23.
Gum, mucilage, sugar, (or heat-producing substances,)	17.44	30.
Woody fibre	8.92	21.
Mineral matter—ash	8.05	6.
	100.00	100.
Containing nitrogen	6.58	3.

It will be seen that in the albuminous, or flesh-forming portions, it far excee the best English or American linseed meal. The same qualities make it m excellent feed for milch cows; and we have, by repeated experiments, prov that for the production of milk it is worth just about double corn-meal, pou for pound.

Indian corn is the next material most in use for fattening stock—universa fed in this country, and much approved in England, where, however, it cann on account of the season, be grown. As an article of food for man and beast is, throughout the world, in great estimation, being adapted to a greater ra of latitude than any other cereal, and nothing can equal this in the varied for of cheap and nutritious food. The cheapness and ease with which it is gro and its abundant fat-producing qualities, eminently make it the staple of American farmer for producing beef, mutton, and pork. While other substan contain more flesh-producing material, there is nothing which makes so mu and so readily, good, firm fat.

There is a very considerable difference in the composition of the differ varieties of Indian corn, some yielding six or eight per cent. more of albumin or flesh-producing substance than others; and in some varieties there bein difference of fifteen or sixteen per cent. in the amount of fat-producing substa A large yellow corn is said to contain thirteen per cent. of albumen, caseine, gluten, while the "Sioux" corn contains sixteen and a half per cent. of same substances. A sound sugar corn contains of sugar, starch, oil, and g which make fat, sixty and a half per cent.; while a small, white flint corn c tains seventy-six and a half per cent. of the same substances.

One analysis made some years ago by Dr. Salisbury, of Albany, gave as lows:

Gluten	4
Albumen	2
Starch	41
Oil	3
Caseine	1
Dextrine	[illegible]
Fibre	21
Sugar and extract	1(
Water	1(
Or, in other words, of nitrogenous or flesh-forming substances, about	1[illegible]
Of non-nitrogenous or fat-producing substances	6[illegible]

Of the other cereals the composition is as follows:

Wheat.

ater	15.26
lesh-forming material	11.64
eat and fat-producing principles	68.74
oody fibre	2.61
iorganic matter, ash	1.75

Barley.

ater	14.65
lesh-forming material	10.84
eat and fat-forming principles	68.31
oody fibre	2.45
iorganic matter, ash	2.75

Oats.

ater	13.09
lesh-forming material	11.85
eat and fat-producing principles	63.34
oody fibre	7.00
iorganic matter	2.72

It will be seen that all the grains are largely composed of heat or fat-forming ıbstances. Of these wheat stands confessedly at the head; it deserves this stinction as being the origin of our daily bread—the source from which the ıief part of the food of millions is derived. As it is an article of such demand, necessarily becomes the most valuable product of the farm, and bearing a uch higher proportionate value, to its cost, to the farmer than any other grains. is seldom used as a feed crop for animals. As a mixed crop (or meslins, as metimes called) with oats, it gives a large yield, and makes a most capital ed.

Barley is a very desirable crop to raise, being, probably, the best crop with hich to sow grass seed, and in feeding qualities is nearly as good as wheat; e straw is much more valuable. As a food for man it does not make very od bread, having, as compared with wheat, less gluten and more starch.

Oats are much the same in composition—oat straw, when cut early, making e very best food for stock.

Leguminous plants, as they are called, embrace the peas, beans, and clovers, id contain a great deal of lime in their composition, and, as we might expect, ourish best in lime soils, and also will bear an addition of lime on those soils ficient in it. Another mineral required by these plants is sulphur; hence the ldition of some combination of sulphur is beneficial. The substance in most mmon use and best fitted for this purpose is gypsum or plaster of Paris. his contains, as is well known, sulphuric acid and lime, and on this account ay be regarded as a special manure for this class of plants. The seeds of as, beans, and other plants of this group are highly nourishing feeding mateıls, and their superior nutritive value is due to the large proportion of nitronous or flesh-forming materials they contain. In these seeds the nitrogenous atter is not gluten, as in the case of grain, but consists of a peculiar vegetable inciple called legumen or vegetable caseine, which name is given to this subance from its resemblance in its chemical properties to the caseine or curd of ilk; and this it is which, as we have before stated, makes bean or pea meal ıch an excellent substitute for milk in raising calves; and containing also me phosphates, it furnishes the muscle, the flesh, and the bones—indeed, all e elements of growth.

Composition of beans, peas, &c.

	Peas.	Field beans.
Nitrogenous or flesh-forming constituents	23.4	23.3
Non-nitrogenous substances fitted to support respiration and lay on fat:		
Starch, sugar, &c.	50.0	48.5
Woody fibre	10.0	10.0
Ash	2.5	3.4
Water	14.1	14.8
	100.0	100.0

The next article of cattle-feed which claims our attention, and which is of the first importance, is the root crop; in connexion with which, however, we wish to call attention to the excellent qualities of the cabbage and Kohl Rabi.

While the cabbage has been long known to be a most excellent vegetable for feeding, and also very profitable, as producing largely to the acre, careful experiments in the laboratory have shown a marked difference in its constitution.

It seems, by a careful analysis, that the young cabbage, before being fully headed, and the outside leaves of those which have formed a solid head, are much more valuable for feeding than the heart or centre of the full-grown vegetable; and, therefore, the most desirable cabbage for the table is not the best to grow for feeding stock.

Composition of cabbage.

	Young cabbage.	Outer leaves.	Heart.	Another analysis.
Water	91.78	91.08	94.48	86.2[illegible]
Flesh-forming or nitrogenous	2.11	1.63	.94	4.7[illegible]
Fat-forming, &c., non-nitrogenous	4.51	5.06	4.08	7.1[illegible]
Ash	1.60	2.23	.56	1.8[illegible]
	100.00	100.00	100.00	100.0[illegible]

The first of these was a cabbage nearly grown, but before any heart had formed; the last is a different analysis, and seems to show a larger amount of both flesh and fat-forming substances. From the numerous useful qualities of this plant, it deserves to be more extensively cultivated as a fodder-crop than it is at present. From the fact that it is richer in oil and nitrogenous matter than most other kinds of green food, and at the same time very succulent, its nutritive qualities are not to be wondered at.

Cabbage is most valuable as a food for milch cows; it increases the quality and quantity of the milk, and the butter made from it is free from any unpleasant flavor. It stands frost, and may be fed from the field after almost everything else is frozen. The yield, too, is large, comparing favorably with Swedes in weight. Professor Voelcker says they got on light land seventeen and a half tons of cabbage to the acre, and but fifteen of Swedes, and says that on well-manured fields they had a much larger yield.

The Kohl Rabi is another plant to which more attention should be paid for feeding purposes. It partakes somewhat of the nature of both the cabbage

and the turnip; having a large turnip-like bulb growing above the ground. It is an excellent, nutritious table vegetable when of moderate size, but sometimes grows to the weight of twelve to fourteen pounds each. It stands the frost remarkably well, and is much superior to white turnips as feed; it resembles the cabbage more than the turnip. The composition of Kohl Rabi is as follows:

Water	86.35
Nitrogenous or flesh-forming substances	2.95
Non-nitrogenous or fat-forming substances	6.22
Woody fibre	2.30
Ash	1.20

A comparison of this with the analysis subsequently given of other roots shows the Kohl Rabi to be superior to turnips and Swedes even, and about equal to mangolds. It is worthy of remark that this plant is an excellent food for milch cows, as it induces a large flow of milk and of a good quality. The butter made from it has none of that disagreeable flavor that characterizes butter made from the milk of cows fed on turnips.

We shall next consider the forage crops, including straw of different kinds, before taking up the root crops, the cultivation of which we propose to treat upon at some length.

However rich and nutritious food may be, like corn, linseed, cotton-meal, or roots, it would never do to feed stock on such alone. Something of a coarse nature is required to fill and distend the stomach and to dilute the concentrated food. For this, hay, straw, corn-fodder, &c., are used, and thus the indigestible woody fibre, which we have noticed in such large quantities, and which constitutes the largest part of the excrements, becomes very important.

Straw is fed in England in much larger quantities than with us, who have such large amounts of hay upon which we depend, and properly too.

Composition of straw.

	Wheat straw.	Barley straw.	Oat straw.
Water	14.23	14.30	12.06
Flesh-forming matter	1.79	1.68	1.63
Fat-producing matter	31.06	39.98	37.86
Woody fibre	45.45	39.80	43.60
Ash, mineral matter	7.47	4.24	4.85
	100.00	100.00	100.00

According to the analysis here given, barley straw is the most desirable for feeding, and it is strange that it is not more extensively cultivated.

The green herbage that in most places covers the soil, in a state of nature, consists, for the greater part, of different sorts of grasses more or less adapted for affording sustenance to herbivorous animals. We may, therefore, regard grass as the food provided by nature for this class of animals; and as in all cases the arrangements of nature are complete and perfect, we cannot be surprised that grass and hay should be a fodder upon which all cattle thrive.

Could we obtain at an economical rate, enough of these materials to feed our cattle, no other description of fodder would be requisite.

Two varieties of grass and hay are usually met with: 1st. That produced in permanent meadows, when the soil is exclusively set apart for the growth of this produce. 2d. That raised from temporary or artificial meadows, periodically cultivated in a rotation of crops. In both cases, the grass is either con-

sumed in a green state by cattle put to graze on the land, or is preserved by drying in the shape of hay.

The produce of temporary pastures is generally considered less valuable as feeding material than the grass or hay of permanent meadows; while the former is often more abundant and profitable, the latter is sweeter and finer, and holds the first rank in the list of fodder plants. The quality of permanent pastures probably varies to a greater extent than any other kind of cultivated land.

While some districts are remarkable for the richness and luxuriance of this grass land, and have become notorious for the superior quality and abundance of every sort of produce raised from this kind of land, in other districts the natural pasture is poor and scanty, hardly capable of affording a subsistence to the animals kept on it.

These differences in the productions of pastures are due to a variety of circumstances besides the more immediate one of difference of soil—the age of the pasture, the treatment it has undergone, the species of grasses growing on it, and especially the state of the soil in regard to water.

All these causes may take part in altering the natural capabilities of the land. The growth of the grasses tends to improve and enrich the surface soil, and is one of the means provided by nature for the amelioration of new or crude soils. By the successive growth and decay of the plants composing the natural herbage, which sooner or later springs up whenever masses of earthy material are exposed to the weather, the upper layer of earth accumulates and is slowly converted into a soil more or less capable of rewarding the labor and skill of the husbandman.

Composition of grass and hay.

	Grass.	Meadow hay.
Water	68.33	14.61
Flesh-producing or nitrogenized substances	4.86	8.44
Fat-producing or non-nitrogenized substances	11.45	43.63
Woody fibre	12.60	27.16
Ash	2.86	6.16
	100.00	100.00

The above table may be taken to represent the composition of good pasture grass and meadow or timothy hay; the dry substance consists mostly of fat-producing materials and woody fibre; and this justifies a remark previously made, that probably, if we had the proper breeds of cattle and an abundance of grass and hay of the best kind, we should not require any other food for fattening our stock.

The qualities of hay depend very much on the age of the grass at the time of cutting, as well as on the treatment it undergoes in the process of being made into hay. It is well known that young grass is more nutritious than that which has passed maturity. This is explained by the fact that the quantity of indigestible woody fibre rapidly increases as the plants arrive at full growth.

For this reason it is desirable to cut the grass intended for hay as early as possible, since a delay at this critical period may greatly reduce the nutritive value of the crop of hay. The quality of hay is often injured by prolonged wet weather and other circumstances over which the farmer has no control. In the case of damage by rain, the soluble matters are washed out, in some cases leaving little else than the woody fibre of the stems.

As there is considerable difference between the composition of common

meadow hay, or natural grass, and that made from clover or artificial grasses, we give the analysis of red and white clover and clover hay.

	Red clover.	White clover.	Clover hay.
Water	80.64	83.65	16.60
Flesh-forming substance	3.60	4.52	15.81
Fat-producing matter	13.78	10.26	37.63
Woody fibre	....	....	22.47
Ash	1.97	1.57	7.59
	100.00	100.00	100.00

On comparing these results with those of the analysis of the natural grasses before quoted, we notice that while the general composition is much the same in both cases, the clover contains, on the whole, more water, and at the same time more albuminous or flesh-forming principles, than the natural grasses; we have no forage plant which on all accounts equals red or white clover.

We now come to the examination of the root crops as feed for stock; and this is the most important branch of the subject. The raising and judicious feeding of roots in connexion with hay, straw and grain, or as preparatory to finishing off with oil-meal or grain, is one of the most necessary subjects for our farmers to study, and in the practice of which they are most ignorant and deficient.

Root crops are generally more difficult to raise, and require more care for their successful cultivation than the other crops previously mentioned.

This is because they are more subject to natural casualties, sooner affected by disease, blight, and unfavorable seasons than other crops, though with us it seldom happens that the failure is total.

Root crops flourish best on land that is neither too wet nor too dry; the roots are rendered watery and hollow by too much damp, and are equally susceptible of injury by drought.

In the cultivation of these crops one important fact is to be noticed—that they cannot gather their food from any portion of the soil remote from the seat of their growth. In all of them the roots are fewer in number and less developed than in those of most other cultivated plants. This will be very apparent to any one who will compare the very short spongioles or fibres on the bulb of a turnip, Swede or mangold, with the long and numerous roots of Indian corn and other cereals, extending, as they sometimes are found, two or three feet. For this reason we must supply them with material for their growth in a form that will admit of its ready appropriation.

It is probable, too, that these crops, sown as they generally are in drills eighteen to twenty-four inches apart, and manured in the drills, do not by any means so much exhaust the land generally as those crops whose plants extend their interlacing roots through every square inch of the soil.

The manure usually applied to root crops with us is well-rotted farm-yard manure and super phosphate. The latter substance is sometimes used alone, but in this case the farm-yard manure must be added previously, or afterwards for the benefit of succeeding crops.

Superphosphate of lime is particularly adapted for promoting the growth of roots, especially Swedes and turnips, supplying early a very essential ingredient in their composition—phosphoric acid. They also require plenty of alkalies, in the form of soda and potash. Hence, in soils naturally deficient in these materials, the addition of common salt or sulphate of soda may be expected to benefit this crop. Mangolds particularly require a large quantity of alkaline

matter, so that the addition of common salt, with other manures, applied to the mangold crop, will, in most cases, be found to increase the produce of this most valuable root.

Root crops are almost exclusively cultivated for feeding cattle and sheep, and generally supply the stock of the farm during the winter, when no green food is to be had. We may therefore regard this produce as a portion of the raw material of mutton and beef; at the same time it supplies material for the manufacture of manure.

Composition of roots.

	White globe turnip.	Swedish turnip.	Mangold.
Water	90.43	89.46	87.78
Flesh-forming substances	1.14	1.44	1.54
Fat-forming substances	5.45	5.93	6.10
Woody fibre	2.34	2.54	2.50
Ash	.63	.62	.96
	100.00	100.00	100.00

	Parsnips.	Carrots.	Potatoes.
Water	82.00	88.26	75.25
Flesh-producing substances	1.28	.90	1.43
Fat-forming substances, including woody fibre	15.07	10.00	22.91
Ash	1.00	.90	.90
	100.00	100.00	100.00

The first thing which strikes one unaccustomed to analysis is the very large proportion of water—being nearly nine-tenths—so that, for instance, in the case of Swedes, cattle must eat one hundred pounds of roots to get eleven pounds of dry food.

The dry substance of these roots consists of feeding materials that are soluble in water, as sugar, a large proportion of pectin, or jelly-like substance, as well as the more valuable flesh-forming materials. It also contains a smaller quantity of insoluble matters, all of which, with the exception of the woody fibre, are digestible and nutritious.

We also notice that the Swede contains less water and more feeding material than the white turnip. Moreover, the dry substance of this root contains a larger proportion of flesh-forming materials than that of the white turnip; this, together with the great yield, accounts for the superiority of the Swede as a general feeding material.

Mangolds are distinguished by the large quantity of sugar they contain, and sugar is one of the substances capable of producing fat in the animal system; thus the superiority of these roots is well known.

But in considering the question of raising and feeding roots, there are some other suggestions touching the matter; besides merely the value of the root itself as an article of food, the expense of raising, the facility of growing, and the amount of crop harvested, are very important considerations.

If one plant yields thirty per cent. more than another of flesh-producing substance or of fat-producing substance, nitrogenous or non-nitrogenous, and the other produces fifty per cent. more than the first in quantity; or if it can be produced at one-half the cost of the first; or if it is always a sure crop, while the first is subject to various casualties of season, insects, &c., and consequently uncertain, then it is manifest that the one richest in flesh or fat-producing

qualities should yield to the other.* Probably a principal reason why more roots have not been grown in this country is that the idea prevails that they are expensive. There certainly is nothing in our climate to forbid it. Our Canadian neighbors, particularly in that large tract lying north of Lake Ontario, grow them in great quantities. We have seen fields of Swedes and turnips there, of ten and fifteen acres, growing most luxuriantly and looking beautifully.

We believe, too, that, as a general thing, the farmers of the United States have not duly considered the great feeding value of roots, and they do not consider sufficiently the enormous amount gathered from an acre, as produced by all these plants.

The analysis of different chemists as to the nutritive qualities of the various roots may differ somewhat from each other, and from practical experiments. But taking good meadow hay as the standard, 100 pounds of it are equal to about 333 pounds of mangold-wurzel; to about 300 pounds of Swedes; 200 pounds of potatoes; 250 pounds of carrots; so that when we compare these with a standard everywhere admitted, it will convince any intelligent cultivator of the soil of their value, relative and comparative. We will mention a few instances by way of illustrating what we regard as a favorable growth of roots.

Thomas Messinger, on Long Island, in this State, obtained nine hundred and twenty-seven bushels, or fifty-five and a half tons of mangold-wurzels to the acre, at a cost of only six and one-third cents per bushel, of which he gives a detailed statement. He says: "The expense of cultivating this crop is less than that of most other roots, from the fact that the leaves spread so rapidly as to keep down weeds, which so accumulate to the great disadvantage of other root crops. This crop is also much more reliable than turnips, not being affected by drought. The value of the mangold-wurzel for feeding cattle, sheep, and swine, I find, after three years' experience, is of the highest utility—an acre more than equalling two acres of corn in an average season. The variety was the orange globe, and the cost per acre of raising, including manure and rent of land, was fifty-seven dollars per acre."

In the admirable report of the Maine State Board of Agriculture we find a statement of a crop of carrots of eight hundred and thirty bushels, or over twenty tons to the acre, grown at a cost of nine and three-tenths cents per bushel, or about seventy-five dollars per acre.

In the same report we also find that, taking the cost of raising and the value for feeding, the produce of an acre of carrots is equal to the same realized on ten and five-sevenths acres of oats.

Mr. Curwen, a distinguished English farmer, says an acre of carrots supplies a quantity of food for working horses equal to sixteen or twenty acres of oats.

Mr. Colman mentions a farmer who usually obtained twenty-five tons to the acre. One farmer at Birkenhead harvested a hundred tons from three acres.

Among a host of valuable experiments, there are two in the report of the Massachusetts State Board of Agriculture which should attract attention from the clearness and accuracy of the statements, the high character of the gentlemen, and the eminent success of the trials.

Mr. William Birnie, of Springfield, raised in 1859, on two acres and a half of land, three thousand one hundred and sixty-six bushels, or ninety-five tons, of mangold-wurzels. The cost of growing and harvesting these was six and a half cents per bushel when stored in the cellar, according to a strict and accurate account kept of labor, fertilizers, &c. There were twelve hundred and sixty-six bushels or thirty-eight tons to the acre, equal certainly to nine and a half tons of hay. What crop is there that from an acre will produce such an amount of nutritious and valuable food with so reasonable an outlay?

Dr. George B. Loring, of Salem, Mass., raised on one and one-eighth of an acre of land eighteen hundred bushels or forty-eight tons of the yellow globe man-

gold, at a cost, by accurate account and calculation, of only nine and one-half cents per bushel. These, at the same rate of calculation, would be equal to twelve tons of hay.

Dr. Loring at the same time reported a crop of Swedes (or ruta-bagas) grown on his farm the same season, 1862. The variety was Skirving's "King of the Swedes." The amount to each acre was, in tons, something over twenty-two, or seven hundred and fifty bushels to the acre; and they were grown, as by an accurate statement accompanying them, at a cost of only seven and five-sixths cents per bushel.

In England Swedes rank deservedly high, and by some experimentalists their feeding qualities have been placed above any other kind of roots.

If the estimate is correct, of their value being in weight to hay as three to one, then this crop would have a feeding worth equivalent to eighteen and seven-ninths tons of hay.

Doyle and others give the average of the turnip crop in England at about fifteen tons, Swedes about twenty to thirty tons to the acre, and of mangolds about forty-five. It varies, however, very much in the different counties of England and of Scotland.

It is not our intention to write an essay on root crops, and we desire to go no further into that branch of our subject than merely to show farmers that roots are economical food; that they can raise them with certainty; that they do not cost much by the bushel; that they show an enormous production, and that on the whole they are cheap and profitable.

We give some of the experiments in feeding both cattle and sheep in Great Britain and this country. Some practices are adopted in England and Scotland which are not followed in this country. Very few farmers here feed cattle in separate boxes, our course being to tie them in stalls; neither do we here send sheep into the field to eat the turnips in the ground.

A very interesting experiment was tried a few years since by Mr. McLaren, manager of the estate of Lord Kinnaird. The cattle experimented on were short-horns, rising three years old, grazed until October and selected for feeding; they were as nearly equal in quality, condition, and maturity as could be, and after being weighed divided into three lots of six each. They were fed in boxes singly, each box numbered, and the animals never shifted. A constant supply of oat straw was kept before them. The experiment consisted in feeding one lot with whole turnips and straw, one lot with pulped or crushed turnips and chopped straw given fresh, and to the third lot the same as to the second, except that the mixture was steamed and fermented. Lot No. 1 weighed at the commencement, October 18, 70 cwt. 24 pounds. Each animal of this lot consumed, on an average, from the commencement of the trial, 168 pounds of turnips divided into three feeds. They consumed about 55½ tons, with a steamed mess once a day for ninety-nine days, adding on each beast an expense of $62 50. This consumption made a gain of 1,285 pounds to March 1; assuming 12½ cents per pound the market price for the beef, the value of this gain is $162 58; deducting the cost of extra food, &c., viz: $62 50, leaves $100 08 as the value of the turnips consumed, or a little less than $2 per ton. The second lot, fed on pulped turnips mixed with cut straw and given fresh, weighed 70 cwt. 70 pounds, and by the 1st of March they had risen to 81 cwt. and 14 pounds, an increase of 10 cwt. and 56 pounds. The third lot, fed on pulped turnips and chopped straw and fermented, weighed 70 cwt. and 4 pounds at the commencement of the trial, and 82 cwt. and 28 pounds at the end, being an increase of 12 cwt. and 14 pounds.

It will thus be seen that the pulped turnips and straw fermented produced a much greater increase in weight than the other two methods of feeding; but, from the feeding with whole turnips being done at less expense, the increase on

the cattle fed that way seems to have paid better than on the others. The result is given in the following table:

Lot.	Kinds of food.	Weight of the lot October 18.	Weight of the lot March 1 following.	Increase in weight.	Value of increase.	Weight of turnips consumed in 135 days.	Value of steamed food 90 days.	Cost of machinery, &c.	Total for extra food and labor.	Clear profit on each lot from turnips consumed.	Value of turnips per ton.
		cwt. lbs.	*cwt. lbs.*	*cwt. lbs.*		*tons. cwt. lbs.*					
1	Whole turnips........	70 24	81 87	11 53	$160 50	55 11 8	$67 50	......	$69 50	$91 00	$1 83
2	Pulped turnips mixed with chopped straw and given fresh.....	70 70	81 14	10 56	147 00	50 16 100	67 50	$22 50	81 25	65 75	1 30
3	Pulped turnips mixed with chopped straw and fermented......	70 14	82 28	12 14	170 00	50 16 00	67 50	22 50	81 25	87 50	1 75

This, with the value of the great quantity of manure made, was considered very satisfactory.

Mr. Horne gave to the Farmers' Club, at Rye, England, the result of some experiments.

He put six bullocks into six separate boxes and supplied them with cut roots; the first month Swedes, the second Swedes and mangolds mixed, and afterwards mangolds alone; in addition, they had six pounds rough or low meadow hay cut into chaff, and five pounds of oil-meal, or value to that amount. They were divided into three lots of two each.

Lot No. 1 had five pounds oil-meal to each bullock; lot No. 2, barley and wheat-meal to the same value; and lot No. 3, bruised linseed. The oil-meal cost $52 50, barley and wheat-meal $44 40, and the bruised linseed $65 per ton.

The experiment lasted four months, or 112 days. Each bullock was weighed before putting up, and each successive month. It was found that the increase was as follows:

Lot No. 1. Oil-meal gained, live weight....................637 pounds.
Lot No. 2. Wheat and barley meal.........................667 pounds.
Lot No. 3. Bruised linseed...................................718 pounds.

It is thus shown that linseed gave most weight for value consumed, and oil-meal the least; each bullock, during the time, consumed five hundred weight of oil-meal, six hundred weight of hay chaff, and ninety hundred weight of roots. It was found that the average increase was 337 pounds live weight each, which is equal to 224 pounds dead or dressed meat. The feeding statistics will then stand as follows:

5 hundred weight oil-meal, at $52 50..............................	$13 10
6 hundred weight low meadow hay, $15..........................	4 50
16 weeks' attendance, at $35 cents..................................	2 00
	19 60
224 pounds of beef..	32 00
	12 40

Thus leaving twelve dollars and forty cents for 90 hundred weight of turnips consumed, or $2 75 per ton; showing that feeding bullocks does pay something besides a most valuable manure heap.

In contrast to this mode of feeding, we also give some instances of feeding in our own country twenty-five years ago.

An excellent farmer, of that day, had seventeen oxen in the stable, which cost him, on an average, forty-seven dollars in November. In February he sold them, dressing twelve hundred each, at $6 per hundred. Their food was meal and hay:

6 quarts Indian meal, at 3 cents per quart, 18 cents per day.
25 pounds hay each, at $10 per ton, 12½ cents per day.

Keeping ninety days, at 30½ cents per day	$27 45
Original cost	47 00
	74 45
Received for beef	72 00
Leaving a balance against cattle of	2 45

Another instance: A fine yoke of cattle cost, November 1, $75. They were fed with good hay and provender, made of Indian corn and broom-seed ground together, and fed three times a day with a heaping measure.

Cost of keeping.

5 quarts corn-meal daily, at 3 cents	$0 15
4 quarts broom-meal, at 1 cent	4
25 pounds hay, at $10 per ton	12½
Making for each ox per day	31½

or 63 cents for two.

Keeping 145 days, at 63 cents per day	$91 35
Commission, drift, interest, &c	5 00
Cost of oxen	75 00
	171 35
Received 2,300 pounds beef, at 5¾ cents per pound	132 25
Balance against oxen	39 10

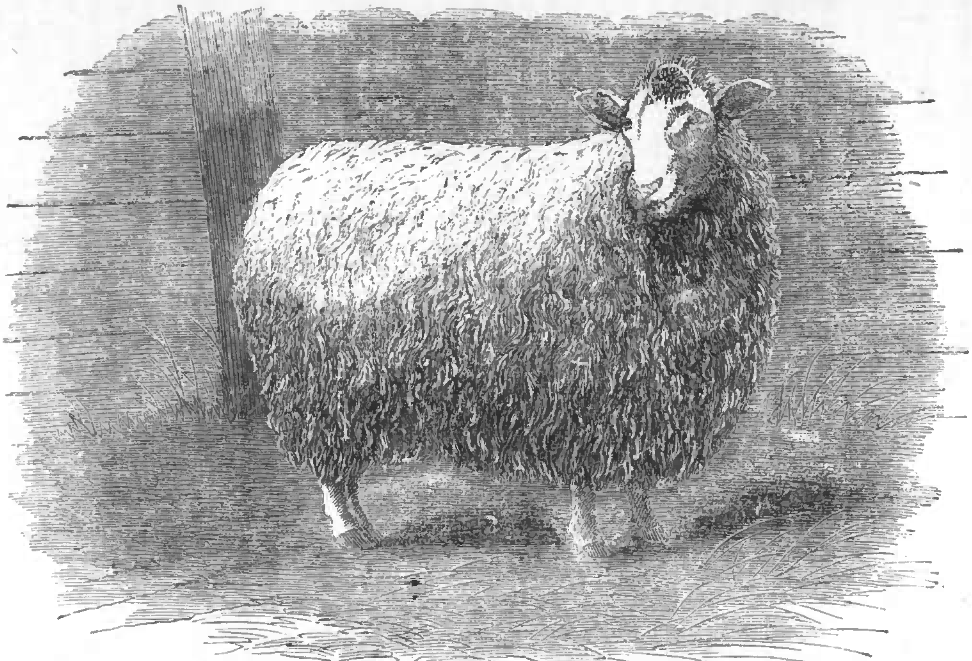
It was this pushing cattle from the first putting up in the stable, with Indian corn alone with hay, the most expensive grain to grow, that made cattle-feeding so unprofitable, especially after the great system of railroads was opened to the limitless west, where corn could be grown at a quarter of the cost that it could in New York, New England, or Pennsylvania, and marketed at their principal cities in the shape of cattle.

The western cattle are, however, daily growing scarcer and higher in price, while the eastern farmers, finding this gradual change, and also that the price of corn is beçoming more nearly equal, are wisely beginning to turn their attention to root-growing and to a more judicious system of feeding their cattle, which are also undergoing great improvements in breeds.

Second only in importance to the fattening of cattle is the feeding of sheep; and here, too, roots form a principal, economical, and valuable article of food.

While Swedes or ruta-bagas are very valuable, and most largely fed, mangolds come in after Christmas as a nutritious and desirable food. It has been sometimes said that they were not good for sheep, and on the strength of one

PLATE XXXVIII.



COTSWOLD AND LEICESTER.—(CROSS.)

Owned by Richards Bradley, Brattleboro, Vt.

PLATE XXXIX.

COTSWOLD AND LEICESTER.—(CROSS.)

Owned by Richards Bradley, Brattleboro, Vt.

experiment Professor Voelcker expressed the opinion that they were not food for sheep. Our own experience is different. We have for years fed mangolds to sheep with no bad effects, and we know they will make flesh; and for cows and ewes nothing will make so much milk; hogs also are very fond of them, raw as well as cooked. We are inclined to think that perhaps the difference between the Professor's experience and ours may have been owing to the much larger quantity he fed, or they might not have been perfectly matured; in which case there is great danger of animals feeding on them scouring, or having diarrhœa.

Sheep, well started on hay, or straw and roots, and finished off with half a pound of oil-meal or a pint of corn-meal daily, increasing that towards the close, will fatten very fast, very handsomely, and leave, if well littered, a large manure heap.

We give a few illustrations of sheep-feeding with hay or straw and turnips, with some meal. There is more nutriment in straw than most people think.

About three years ago we put up one hundred grade sheep of Southdown, native Cotswold or Leicester blood, averaging one hundred pounds each; they were in good condition from good pasture, and were put up about the middle of November, and fed until the middle of February, twelve weeks. Their food was somewhat varied during the time, but averaged three pounds of hay, four quarts of Swedes, and afterwards mangolds, and a pint of corn, or its equivalent in oil-meal; they had besides, daily, a feed of bright straw, of which we made no account, as it went with the manure; they had running water and salt, and a good, comfortable enclosed shed. They gained more than two pounds a week and had no sickness or trouble of any kind. The master's eye was constantly upon them, and when any sheep showed symptoms of not eating well or gaining, he was drafted out and a little change made in his food for two or three days, when he would be all right. In fact, they were kept, tended and fed as sheep should be by any man who pretends to be a thorough farmer, and expects and desires to make the most out of his stock; and there is none any more profitable than a good flock of sheep for breeding or feeding.

These sheep were sold, unshorn, at 10 cents per pound, and averaged one hundred and twenty-five pounds each, clear through, making $1,250.

The sheep cost, delivered, $5 each, averaging 100 pounds........	$500 00
They consumed 17 tons hay, called $10 per ton..............	170 00
138 bushels Indian corn, at $1 per bushel, or its equivalent in oil-meal..	138 00
1,050 bushels Swedes and mangolds, at 10 cents per bushel......	105 00
Three months' labor and attendance.........................	45 00
	958 00

Showing a profit, as commonly reckoned, of $292. In my judgment, however, the true way for the farmer to reckon is not the profit over the cost, or the market value of what he could sell, but first to see how big a manure heap he has from his animals, and then, in addition to that, how much he got for his crops by putting them into and through the animals. I had sixty two-horse wagon loads, worth certainly $2 per load, either estimated by a market price or by comparison with any special fertilizer. Taking, then, the first cost of the sheep from the amount received, and dividing it reasonably among the amounts of articles fed, and it will be seen that I sold my hay to my sheep at $18 per ton, my corn at $1 75 per bushel, and the roots, &c., at 15 cents per bushel.

This was before our products had reached famine prices, and amounted to

nearly twice what the crop would have sold for, and on the corn and hay to three or four times what they cost me to raise them.

The experiments of feeding sheep tried by the Parlington Farmers' Club, and recorded in the Royal Society's journal, are very interesting and useful, although their purpose was to try a comparison between different breeds of sheep, to ascertain the best class for their locality, rather than trying different kinds of food.

They fed seven different lots of sheep, each containing six, from November 11 to February 14; these were the cross from the Teeswater, North sheep, Lincolns, Southdowns, Shropshiredowns, Leicesters and Cotswolds. The sheep received each, daily, ten quarts of Swedes and a half pound of oil-meal. They were fed fourteen weeks, or ninety-eight days, and gained on an average thirty-two pounds each during the time. These illustrations abundantly show the economy and profit of proper winter feeding with turnips, meal, and hay, without reckoning the manure made, which, with eastern farmers, is one of the chief inducements to fatten cattle.

This brings us to the close of the subject, in the hope that what we have written may not be entirely without profit to the farmer.

A brief summary of what we have intended to demonstrate in the foregoing pages would be, first, the fact that in this country, and especially in that part east of the Alleghanies, there is a great deficiency of butcher meat, especially of beef and mutton, which is each year becoming more extended, as the population increases in a much greater proportion than the production of cattle and sheep. Second, that this deficiency must be supplied by one of two ways, or both, by importing from the far west, or from Canada, fat animals ready to be killed, or half fat, to be finished for market by our own farmers, or we must increase our amount of food by a more careful and thorough feeding of the stock we have, making more on every creature we have; and, also, we must add to the number by raising more calves, and this must be done without interfering with the products of the dairy, by a judicious use of skimmed milk, oil-meal, oat-meal, &c.

In feeding cattle and sheep, instead, as is commonly the case in this country, of commencing at once with grain, a more economical course is to feed turnips, Swedes, mangolds, and other roots, till the beasts are in a good fattening condition, and then to finish them off by joining with the roots and hay, oil-meal, cotton-meal, Indian meal, or some other rich concentrated food.

We have in this connexion endeavored to show the importance of the root crops, the cheapness with which they may be grown, and their great utility and value as food for cattle and sheep; and this has been illustrated by examples and instances in this country and Great Britain.

The composition of food is a subject which naturally arose—both meat, as food for man, and hay, straw, roots and grains, as feed for cattle; the analysis of these articles, and the various experiments as to their relative value, have been shown at some length, and the conclusions, as above drawn, have been stated.

The subject is one which has for years engaged our attention, first called to it by one of the most eminent farmers of the country; and if this article, made up from the writings of English and American farmers and chemists, with the writer's own experience, shall have any influence in calling the attention of our farmers to this most important subject, we shall feel abundantly satisfied with the results of our labor.

THE PENNSYLVANIA BARN.

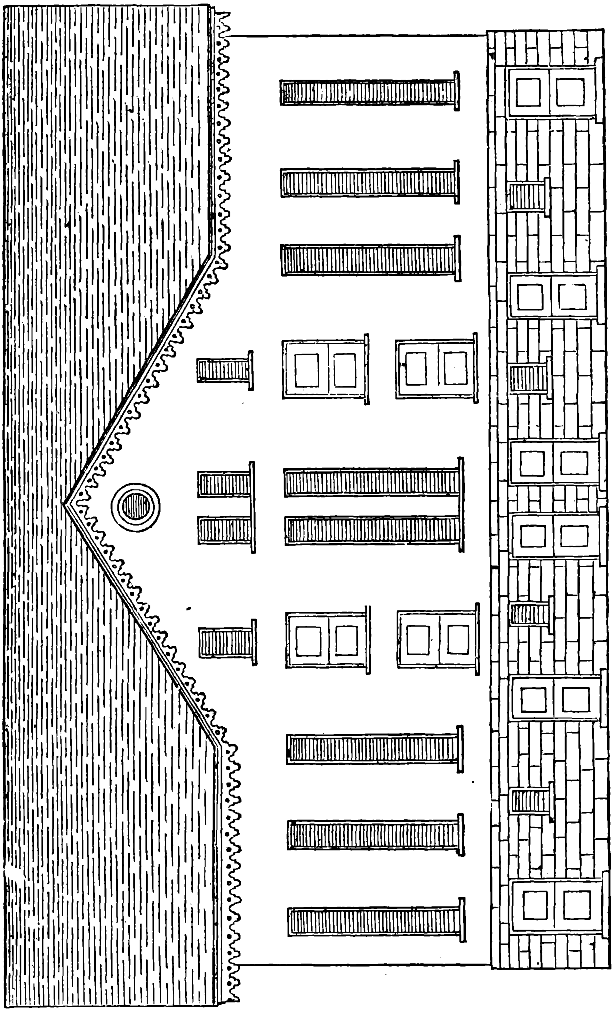
BY HON. FREDERIC WATTS, OF CARLISLE, PA.

It is by no means a conceded principle that a barn is a necessary or even a useful appendage to farm operations, for we find the people of entire districts of country, and they not differing much in their climate or agricultural productions, whose views, if we may judge from their habits, differ essentially on this point. As characterizing States, indeed, Pennsylvania stands prominent in the importance which her people have attached to a barn, as an essential element in the constitution of a farm. Their estimate of its value, in the profitable prosecution of their business, has given to it a form, shape and structure which distinguishes it from a mere shelter for animals or cover for hay and grain, whether they be stables, corn-houses, ricks, or other such devices. The Pennsylvania barn combines all these and other profitable conveniences within itself; and it is at least questionable whether, on the whole, it is not at less expense. There is, perhaps, no section of country in the United States where agriculture is pursued with such profitable results as in the southeastern counties of Pennsylvania, including Cumberland, York, Dauphin, Lebanon, Lancaster, Chester, Delaware, Montgomery, Bucks, and Berks, where farms rarely exceed one hundred and fifty acres, and upon each of which the bank-barn is deemed as absolute a necessity as the plough itself. Apart from any theoretical view of the subject, much weight will attach to the judgment which this experience has pronounced, when it is perceived that the result of that experience has been an amount of solid wealth that is not to be found elsewhere. It must be conceded, however, that long habit had made such an impression of the completeness of the Pennsylvania barn as to have forbidden any improvement upon its structure for a long time. But the progress of the age has made its innovation here too, with results highly practical and useful. It is our purpose to delineate an improved bank-barn, keeping in view a moderate cost of construction, convenient stabling for cattle, the most capacious storage for hay, grain, and straw, corn in the ear, and wagon shed, cistern, root cellar, all combined under the same roof, and especially economy of labor in the use of these departments. The business of a farmer consists of bodily labor, and in every improvement for his use, the study should be to economize the work of the hands, substituting that of the horse, mule or ox.

There is a principle which should enter into the construction of every barn, that its size should be in its height, whilst its height should not necessarily increase the amount of labor requisite for its use; for it will be readily perceived how much the weight of the grain itself must contribute to the capacity of the mow which holds it. A few feet of additional frame in height adds but little to the original cost; whilst to extend the frame horizontally costs the same, and requires additional roofing, and the advantage of weight is comparatively lost. This height of barn, and economy of labor in using it, is attained by constructing the inner frame with two sets of floors, one above the other, using the upper one to drive into, thus reaching with the loaded wagon the height of the middle of the mow, instead of the bottom of it, and thus, too, superseding the necessity of pitching grain to any great height. And here it must be observed that the frame across the barn, which is between the floor and the mow, must be so constructed as that there shall be no cross timber in the

way of the free use of the horse-power fork. In barns heretofore built, this principle has not been observed, whereby it has been necessary to raise hay over these cross-timbers to a height which requires much more time and unnecessary labor than is otherwise required. The hay-fork should be used with a

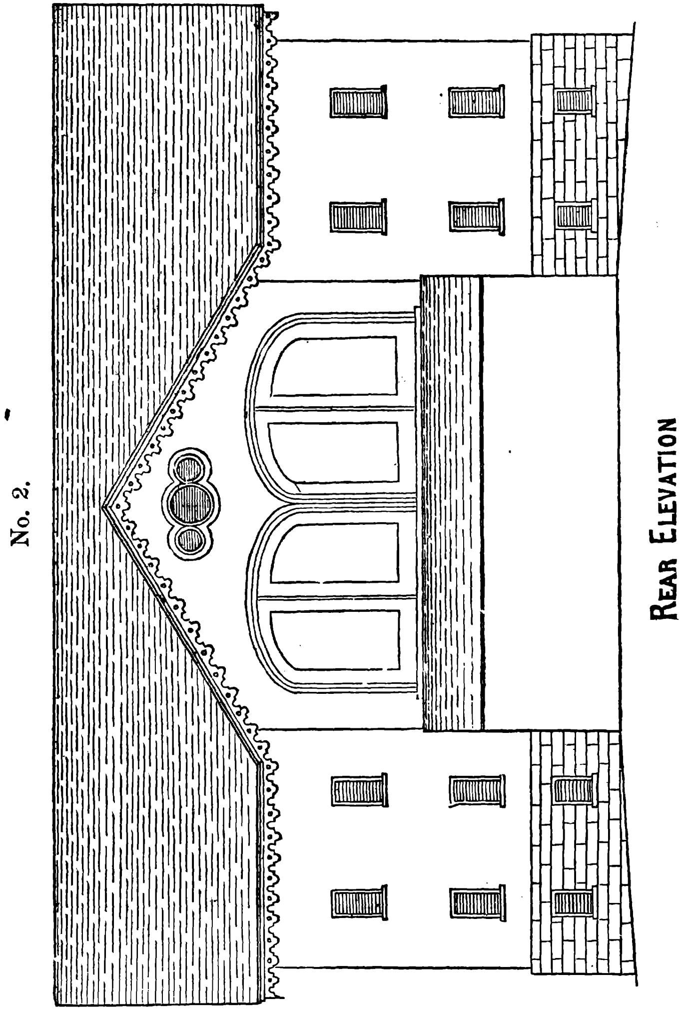
No. 1.



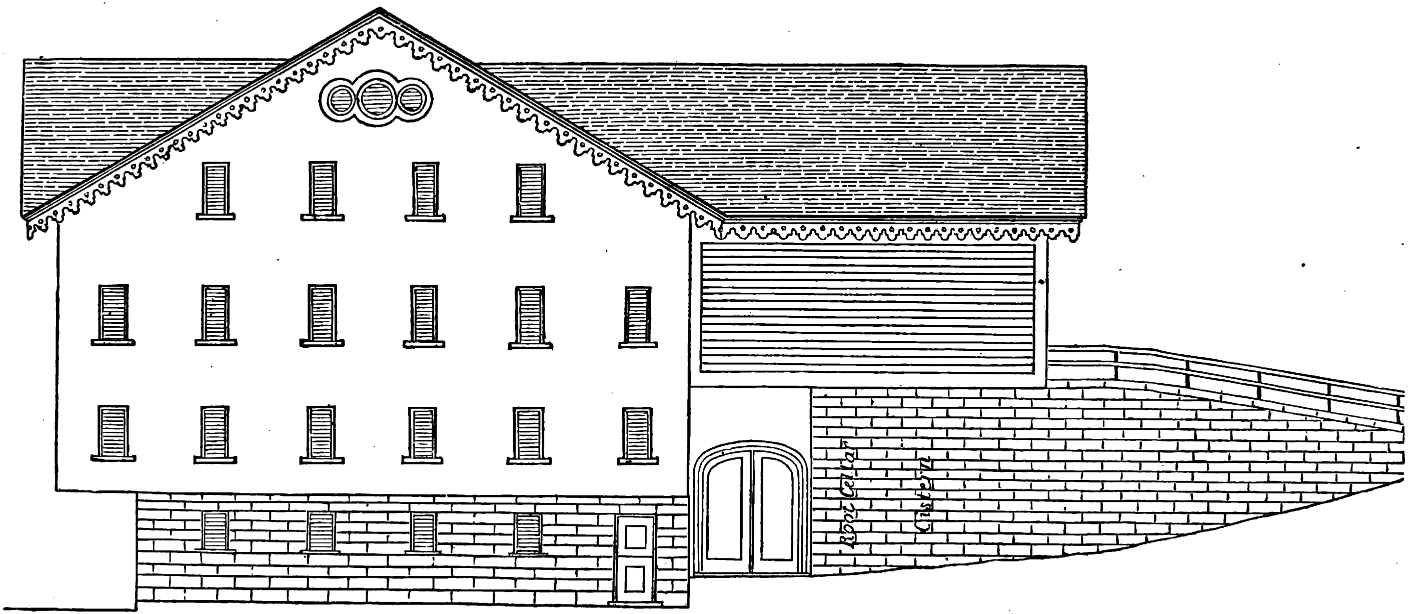
Front Elevation
Scale, 16 ft. to the inch

double pulley, and the horse, walking on the opposite floor, can raise, without any extraordinary exertion, as much hay as the fork can take; in fact, with a mow thus constructed, a horse will, when the wagon is full, throw off almost one-fourth of the load at the first draught; the bottom of the mow being about nine feet below, the hay passes off without the immediate necessity of a man in the mow to dispose of it. And it will be found that the capacity of the two mows filled up to a point about three feet above the siding of the floor, when pressed down by the grain afterwards put upon it, is equal to about sixty tons. And in putting away grain, which must necessarily be done with a hand-fork, this mode of construction of the frame will be found equally convenient,

inasmuch as there is no timber in the way of free access to the mow. The barn should be built in a bank having an elevation of about nine feet; and by giving to the wagon-way an elevation of about eight feet more, the upper floor is reached without any severe draught upon the team. In this wagon-way, and ten feet from the barn, is erected a cistern or reservoir for water, capable of containing about three hundred hogsheads, three-fourths of which will be above ground, and the bottom of which will be about eighteen inches above the bottom



of the stables, the water from which, with the use of an ordinary hydrant, may be drawn in the barn-yard or any of the stables. This being built of stone, should be made very strong, well cemented within, and tightly weatherboarded upon four-inch studding on the outside, allowing a column of air for the protection of the water from the frost in winter and the heat in summer. This reservoir, extending entirely across the road-way, may be arched with stone or

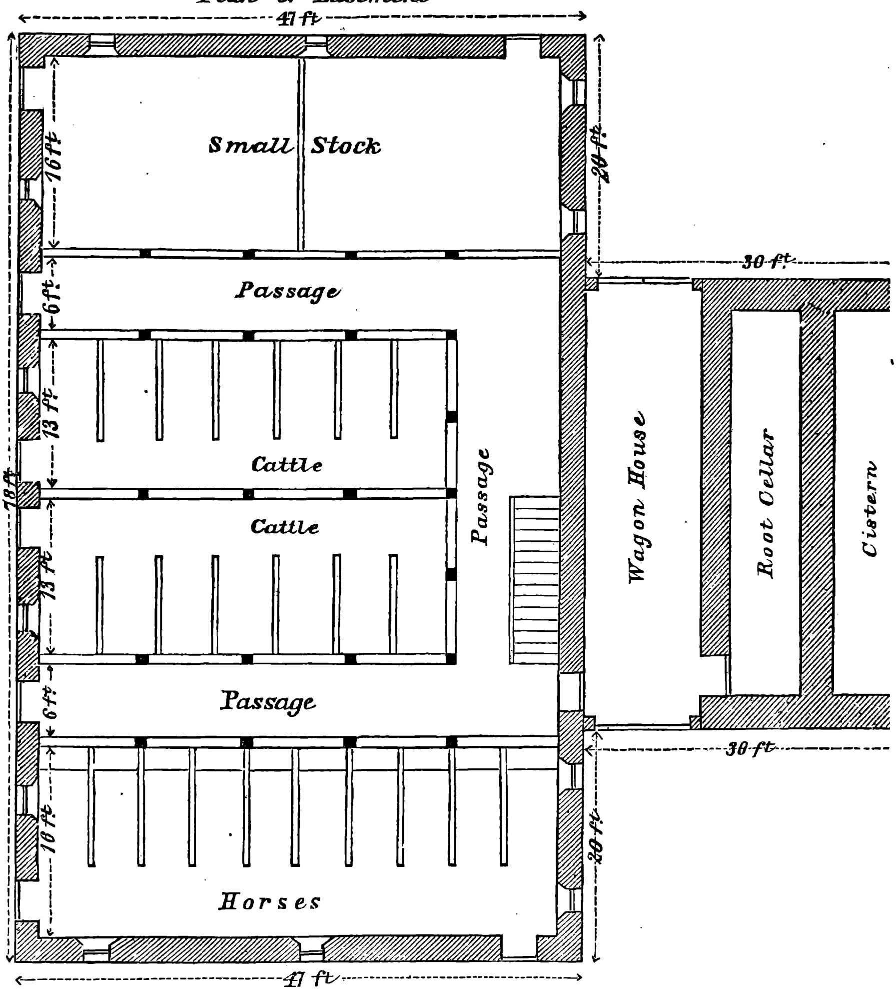


End Elevation

brick, or covered with timber, extending from the barn out so far as to cover the cistern, and the floors of the barn extend out as far as the ends of the cribs, and here the barn doors are placed; and in the centre of the space between the cribs the horse-power is permanently fixed, allowing room on either side for the passage of the wagon into the floors; it being only necessary to remove the arms when the power is not in use. By this means the operation of threshing is all under the cover of a roof. There should be, too. an additional

No. 4.

Plan of Basement



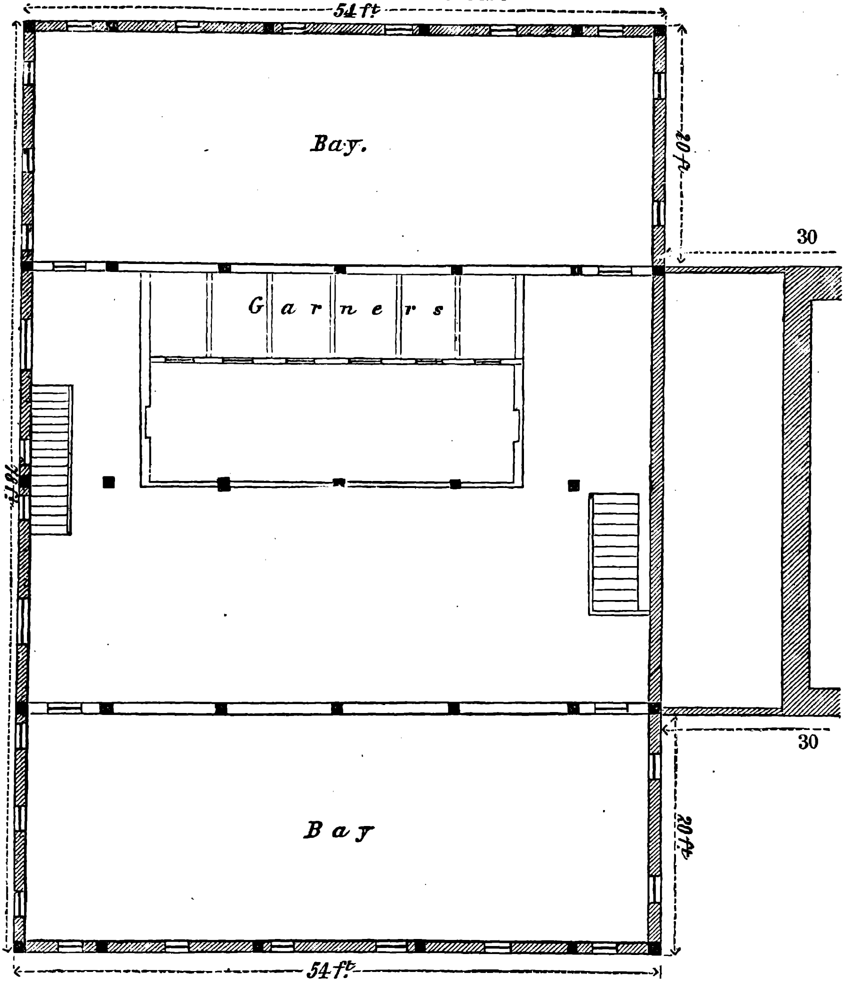
apartment alongside of the cistern in the wagon-way for roots, for which there is abundance of room. The space of ten feet between the cistern and the barn furnishes the necessary wagon-shed and gives access to the lower floor, from which all grain is loaded. One of the lower floors is occupied with garners, and inasmuch as there is more room than is required for this purpose, one end should be occupied as a workshop, where all tools are kept and used. In one

NOTE.—The size of the page renders it necessary to cut off, in Nos. 4, 5, and 6, that portion of the engraving representing the root cellar and cistern. It is, however, shown in Nos. 7 and 8.

of the upper floors, where the threshing is done, and immediately under the shaker of the threshing machine, there is an opening of six feet by three, having an iron grating, with meshes two and a half inches square, sunk into the sleepers so deeply as to allow their being covered by plank, fitted in when not in use. Through this the grain and chaff pass to the lower floor without intermixture of straw, and thus saving all the time usually occupied in covering up and disposing of the grain upon the same floor where the threshing is done. And it

No. 5.

Plan of Grain & Feed Floor.

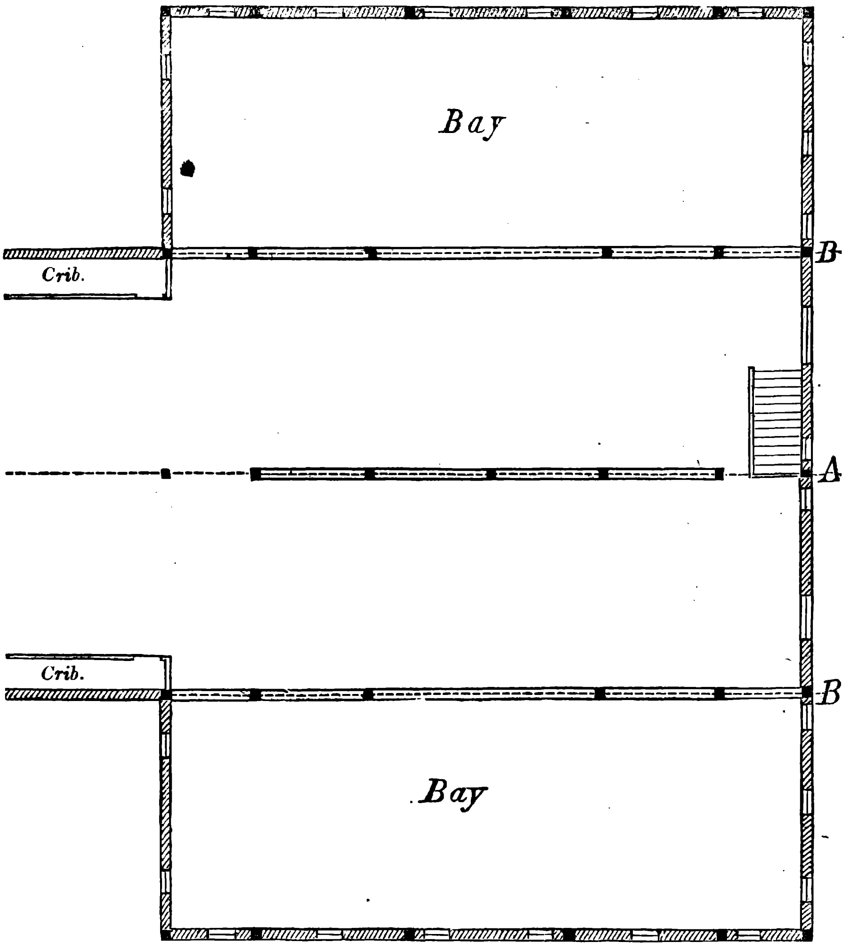


Scale 16 feet to the inch

will be found, from experience, that this saving will enable the farmer to get out, with the same power and hands, just double the quantity, in any given time, that he can do in a barn differently constructed. Another advantage is, that any quantity of grain may be threshed without stopping to clean up, which is a part of the process requiring fewer hands. The band wheel of the horse-

power should be under one of the cribs, which is effected by raising the floor about eighteen inches, allowing one-half of the diameter of the wheel to be sunk below. The cribs should have no doors, but openings should be made by movable slats, so dovetailed as to keep their place, and the corn is taken from the cribs by boxes at the bottom, the sides of which are so constructed as that they may be removed when it is necessary to take out any quantity.

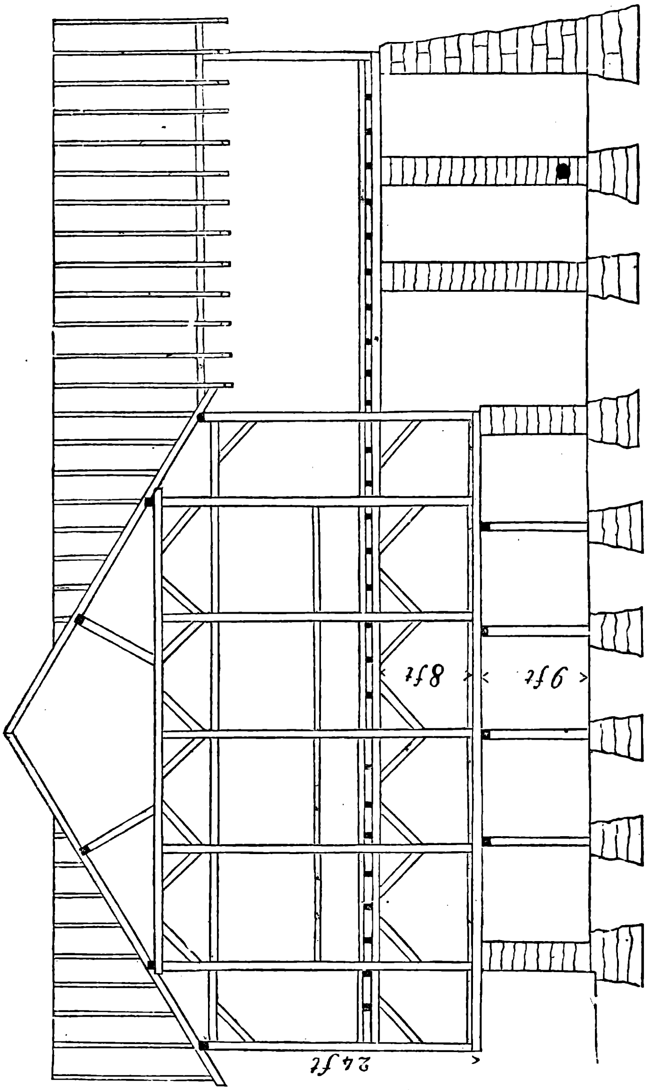
No. 6.



There is much improvement to be made in the construction of the stall, floor, rack, and trough of the stable. The stalls should be partitioned by oak slats, two inches wide and two inches apart, on each side of studding four inches square, whereby the free passage of the air through the entire stable is secured, for there is nothing more important than perfect ventilation where there is such constant necessity for it. The floors should be paved with blocks exposing the end of the timber. In the erection of a barn, the ends and waste-pieces of square timber, cut into six-inch lengths, may be thus used. They should be paved together upon a bed of lime about four inches deep, to prevent the decay of the timber. Fill up with wood any interstices there may be between the blocks; pour gas pitch upon it, cover it with sharp sand, then the whole with

straw, and put the horses upon it, when it will become a solid mass impervious to water. A floor thus constructed we have had in use for ten years, and it is now apparently as good as when made. The frame of the racks should be fourteen inches in the clear, and the rungs of three-eighths iron, with a head at one end and a nut screwed on the other; it should be placed perpendicularly behind the trough, and over a board sloping to the trough, whereby the hay seed is carried into it. The slope, which gives capacity to the rack, is into the

No. 7.



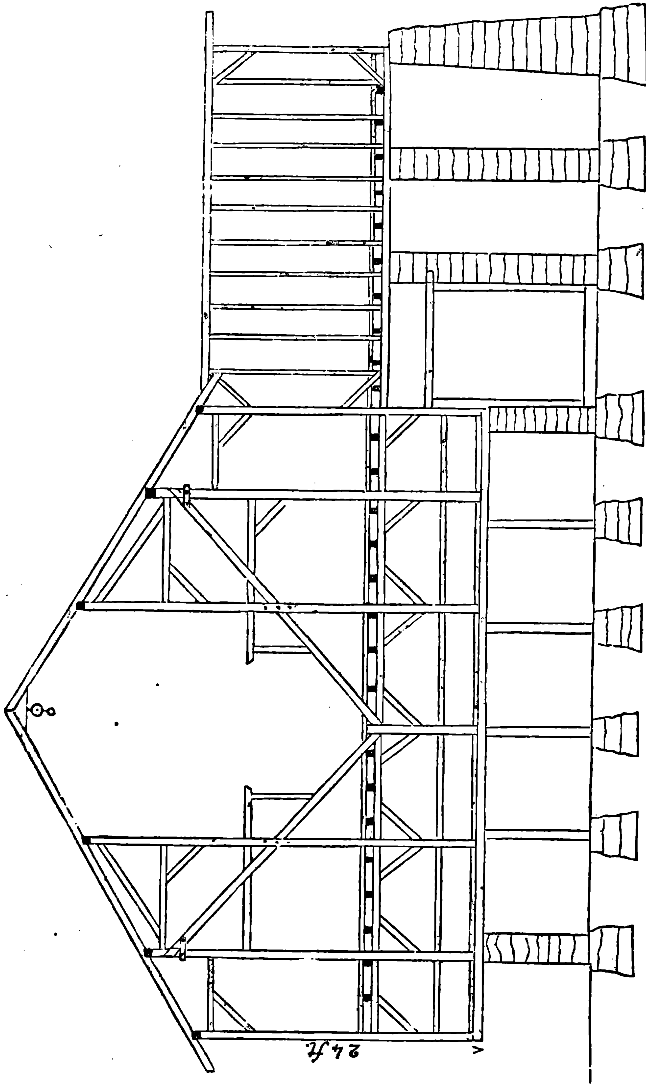
FRAME-WORK ON LINE A OF FIG. 6

gang-way, whereby access to it is rendered the more easy, which, in feeding long fodder to cattle, is a matter of much moment. The space under the trough is boxed, sloping also into the gang-way with a lid, and which has a capacity for grain equal to all the demands of the stock. The gang-ways themselves

may be either planked or filled with gravel properly shaped, and saturated with gas pitch, which becomes perfectly hard and impenetrable by rats. The space under the stable floors is usually the hiding place of rats; the proposed method of making the floors prevents this.

One of the essential elements in the value of a barn is, that it affords the means of making and preserving manure. Barn-yard manure, in the process of farming, has no substitute of equal value; and without the barn you cannot

No. 8.



FRAME-WORK ON LINES B. B. OF FIG. 6

have the manure, and dependent upon the character of the barn is its quantity and quality. If straw, hay, and fodder are thrown directly from the barn floor to the yard, they, in a great measure, remain straw, hay, and fodder. The tramping of cattle upon it gives it the appearance of manure, but the appearance

is, in a measure, deceptive; it wants the process of having passed through the stables. A farm must, in the course of time, become exhausted and fruitless unless replenished by manure, and this cannot otherwise be so cheaply attained as through the medium of the barn. In the southeastern part of Pennsylvania, already mentioned, there has been a longer practical application of mind to the subject of agriculture than is often to be found, and perhaps with more profitable results; and here a barn is the first building in the construction of a farm.

That what we have said with regard to the improvements in barn-building may be the better understood, we annex drawings (Nos. 7 and 8) of some of the parts. The drawings represent the sleepers of the upper floors as being across the floors. They may be so, but it is better that they should be longitudinal with the floors, extending over the overshot.

The drawings are intended to exhibit a barn 78 by 54 feet, the main frame being 40 feet, and each overshot 7 feet, the back one resting on the foundation wall. The walls are 78 by 47 from out to out, the front overshot extending 7 feet over the front wall. The roof all around should extend two and a half feet over the weather-boarding or walls.

A very fatal mistake is sometimes made in the erection of ventilators in the shape of cupolas upon the comb of the roof. All hay and grain undergo a state of fermentation a few weeks after they are put away. The emission from it is a dense, damp fog, which passes through the cupola and constitutes the very best conductor of lightning that could be devised; and as this process happens at a season when thunder-storms prevail, it is doubtless the cause of the destruction by lightning of many barns. The object is better attained by cribbing the gable ends of the barn for ten feet below the top of the roof, by placing the weather-boarding three-fourths of an inch apart, and feather-edging the boards so as to preserve its solidity of appearance from the outside. The substance ventilated from the barn is thus so diffused and broken up as to avoid any danger from the power of conduction by its ascending column.

Whilst the water from the cistern may be easily conducted to any part of the stabling, experience does not sanction its introduction there at all. The drippings and accidents occasion a dampness and wet which are objectionable, whilst the pipe passing under the stable and depositing the water in a covered trough in the barn-yard immediately in front of the stables is sufficiently convenient for all practical purposes. The size of the cistern, with the constant use of water by the stock of the farm, are nearly equal to all the water which will fall upon the roof during the year, so that there will be little to run off from the escape-pipe at the top, thus avoiding the deleterious effects which always result from the copious flow of water into the manure yard.

We may add, in this connexion, that racks swung upon a gallows in the barn-yard is a very decided improvement in the way of feeding cattle. They possess two marked advantages: first, suspended by chains, they may be readily raised or lowered, as the manure pile increases or is entirely removed; and, again, they yield to the frequent necessity of the escape of one animal from the attack of another. A convenient shape of such a rack is ten feet long, fifteen inches wide in the bottom, and three feet at the top in the clear, with rungs four feet long of three-eighths iron, with a head below and a nut above, suspended by a loop of the middle end rung, which is made of a little stronger iron, and put in by a nut below.

GREEN MANURING AND MANURES.

BY JOHN F. WOLFINGER, OF MILTON, PA.

By green manuring we mean the sowing, growing, and ploughing down of some vegetable crop while it is yet *green*, or living and growing, to benefit or improve the soil and its future farm crops. The green manurial plants and grasses used for this purpose may, if necessary, be grown upon one field, and cut off, removed to, strewn over, and ploughed down into another field. But it is always the cheapest and best plan to sow and grow the crop, wherever it can be done, upon the field where it is to be used as a manure. In discoursing upon this highly important subject I will arrange what I have to say under appropriate and distinct heads.

1. Ancient Green Manuring.

Some people have an idea that green manuring is a *new* thing under the sun, but they are greatly mistaken. The ancient Romans used to sow, grow, and plough down various plants and grasses as green manurial crops, as we learn from the works of Rome's most distinguished agricultural writers, to wit: from Cato, Varro, Celsus, and Pliny, who flourished before our Saviour's time, and from Columella and Virgil, who lived afterwards.

The ancient Grecians understood the value of green manures, for Xenophon, their countryman, a man celebrated as a historian, a general, and a philosopher, recommended and taught them the use of such manures.

It is very likely the ploughing down of green crops as a manure was practiced by other nations also at a still earlier day in the history of our world. And it is very probable that the idea of using such crops for *manurial* purposes was first derived from the visible good effect in ploughing down dense masses of *weeds*. But, be these things as they may, there can be no doubt about the fact that the art of improving soils and crops by the use of green vegetable manures was known and practiced in ancient times.

2. Modern Green Manuring.

The inhabitants of Flanders, (now Belgium,) in Europe, were the first among modern nations to sow and grow suitable plant and grass crops to be ploughed down into their soils for manurial purposes, to wit, such as red clover, spurry, sanfoin, &c. They were driven to the use of this kind of manure through "necessity, the mother of invention;" for their soil generally consisted of white, loose, and porous sand, ill adapted to the growth of wheat. Their soil was naturally very much like the sandy district upon our sea-coast in New Jersey and Maryland, and the sandy plains sometimes occurring in the valley of the Connecticut river.

But the Flemish gradually converted this barren land into a most fertile loam; they at first cultivated these districts to a depth of only three or four inches, but by degrees ploughed deeper as their soil became enriched by the application of manures, until they at last secured for themselves a very deep and loamy soil upon these ancient sandy barrens. In 1819 their average farm crops per acre were said to be, of wheat, 32 bushels; rye, 32½ bushels; oats, 52 bushels; po-

tatoes, 350 bushels, &c. From the beginning of the 16th century down to our own day, the Flemish have continued models of neat, economical, and profitable farming. They have also the honor of being the first nation that adopted a *regular rotation* of farm crops, or what is commonly called the *alternate system of husbandry.* It was a leading principle with them to make their *farms closely resemble gardens.* And to do this they had *small* farms, and aimed at three grand points, to wit: 1. The accumulation and careful use of the manure 2. The destruction of weeds; and 3d, the frequent and deep stirring or pulverization of the soil. No crop was of more importance to them than red clover; for, as many of them had no *natural* meadows or grass lands, red clover was not only relied on to supply them with sufficient fodder for their cattle, but also to make much manure for keeping up the fertility of their soils. Radcliffe, in writing about them, says: "*Without clover no man in Flanders would pretend to call himself a farmer*"—a maxim worthy of adoption by our American farmers. Their clover was generally given to their cattle in a green condition; but whenever they had more clover than could be used in this way, it was cut off with a reaping hook and converted into hay.

This cut clover was tied up into bundles of seven or eight pounds weight and set up against each other like grain-sheaves, to dry properly. The mowing and turning of it, as we make clover-hay, caused them a loss of too many of its leaves and fruit-buds. Upon *all* soils that would produce clover the cultivation of red clover formed a part of the course in every rotation of crops, as this clover was sown with every sort of grain—with wheat, rye, barley, oats, and flax. They did not grow spurry much except on very dry and sandy grounds, where the red clover failed to grow well. Here they had recourse to spurry to obtain the necessary fodder for their cattle during the winter. Spurry answers very well upon such soils, as it springs up readily and ripens its crop in about six weeks.

The alternation of crops—that is, the growing of a regular series of different farm crops upon each and every field in successive order—is an essential requisite to good farming. It was this, in connexion with their green manuring, that then gave the Flemish husbandry such great and acknowledged pre-eminence over that of every other country. Long before their system of husbandry was introduced into England, Flemish farmers insisted upon it, and their success in farming justified them in the opinion, that land *does not need rest, or fallowing,* where this system is practiced. Radcliffe, if I remember rightly, says he saw the operation of harvesting grain, and the ploughing of the ground, and sowing of turnip-seed, all going on at once on one and the same field in Flanders; the ground was ploughed up and resown with another and a different crop as soon as the grain or other ripened crop was cut off and removed. It is by the same or similar alternations of crops that the farmers in the county of Norfolk, and of other sandy regions of England, once very poor and unproductive, have converted them into the most fruitful, wealthy, and populous districts of England. This same system has wrought similar changes of agricultural improvement in Scotland and Germany, and it will, if properly and perseveringly pursued, produce equally beneficial effects in our own country. There is nothing in farming that requires a nicer judgment, and nothing on which the farmer's profits more depend, than upon the order in which the various farm crops cultivated are made to succeed each other upon our fields. It may also be proper to say here, that the Flemish kept large quantities of cattle; *one beast for every three acres of land was a common proportion;* and in very small occupations, when much of the farm work was done with the spade, the proportion of cattle was still greater. Their cattle were fed on turnips, potatoes, carrots, &c., which were chopped together in a tub with their leaves, and mixed up in boiling water with rye or buckwheat meal, about two pailfuls of which were given to each cow per day.

The green manuring and alternate husbandry, so successful in Flanders, gradually extended themselves, with suitable and necessary variations, into Germany, Holland, France, England, Scotland, and other countries of Europe.

3. Green Manurial Plants and Grasses.

The question arises, what are the best plants and grasses for green manurial purposes?

The following is a list of the best and most commonly used European green manurial plants and grasses, to wit:

1. Turnips, (*Brassica rapa.*)—The turnip belongs to the cabbage family of plants, but it differs from its relations in this respect, that it delights in a loose, warm, and dry soil, either sandy or calcareous, and in wood ashes, rather than in animal dung, as a manure. It grows to the greatest perfection on new grounds of this character; the sooner its seeds can be put into the fresh moist soil, after the ground is ready for seeding, the better. The late Dr. Evan Pugh, president of the Pennsylvania Agricultural College, in writing on this point says:

"Causes apparently very slight may often produce the most marked result. The smaller the seed the more likely in general it is to be influenced by almost imperceptible causes. In *sowing turnips*, English farmers not unfrequently remark that in dry, warm days a vast difference is made in the crops by planting the seed in the *fresh moist soil, just after* the marking-out plough, and in planting in the same soil *after* it has had two or three hours to dry.

"The very intelligent farmer of the Duke of Bedford, in England, informed the author, (Dr. E. Pugh,) a few years ago, that he had noticed a diminution equal to one-fourth the crop produced by letting a row thus dry, before planting, while the men were eating their dinners."

If this quick sowing of the turnip in the freshly stirred ground is a matter of such great importance in the moist and cool climate of England, it is certainly far more important here in our own hotter and drier climate. As a hint to a wise man is said to be sufficient, I make no further comment on this point. As soon as the sown turnip-seed is drilled in, or sufficiently covered with earth, the ground should be pressed down with a heavy roller; such rolling will not only bring the earth and the seed into close contact, but secure to the seed the full benefit of the soil's existing moisture, and so insure the speedier and more certain germination and growth of the seed. This is not the whole benefit of such rolling, for it serves also to protect the germinating and rising crop from the ravages of the turnip fly, as many experiments concur in proving that this fly does far more harm where the soil of the turnip crop is loose and porous than it does or can do when the soil is close and compact. Turnips are very useful for fattening cattle of every kind; sheep fatten speedily on turnip tops, their leaves merely, without eating their bulbs or roots. Turnips form a regular farm crop in Belgium, Holland, Germany, and England, for feeding off in the field, by sheep and horned cattle, as well as for winter use for their live stock in the barn. Turnips are also, in these moist and cool summer climates, one of their best soil-renovating crops, and have, for several centuries past, been used as such with very great advantage. The large, rough, spreading, and gas-collecting leaves of the turnip draw more nourishment from the air than their roots do from the soil; and hence this crop not only serves to keep farm animals there in good order, but the manure resulting from it also keeps the land itself in a good and an improving condition, as the turnip fields so eaten off by sheep and cattle are left in excellent order for producing a wheat crop. The farmers of England find it very advantageous to turn their sheep upon their turnip fields and let them eat off their tops or leaves, and also as many of the turnips themselves as they wish. This practice not only saves them the time and labor of harvesting much of the crop, and of hauling from the barnyard the manure that it would have made in the barn, but at the same time scatters and deposits all of the fertilizing matter contained in such animal ex-

crements right down upon the spot or ground where it is wanted for the renovation or improvement of the soil.

The four grand staple agricultural products of England consist of, 1, wheat; 2, turnips, mostly Swedish turnips or ruta-bagas; 3, barley, and 4, grass; including clover and vetches or tares. These crops are, for the most part, made to succeed each other upon their several fields in this same order. Thus, they grow wheat to furnish bread for themselves and the nation, and turnips to feed the sheep that supply them with clothing and mutton, and barley to be malted and brewed into beer and ale, their favorite drink or beverage, and lastly, grass, in pastures, meadows and fields, to feed and fatten their horses that do their work, and their cattle that supply them with beef and milk, butter and cheese. Oats are occasionally grown instead of wheat, and beans instead of turnips, but these variations and their special crops of hops, potatoes, flax, and the like, do but little disturb this general rotation of crops throughout England. But as turnips, which were long regarded as the foundation of their whole system of cropping, are failing to grow well in many localities, many of the high or best farmers of England are beginning to abandon the growth of turnips, and to substitute in their place, and with decided advantage, the *mangold wurzels*, a species of beet. The preceding English rotation of crops, or "*whole four years' course of husbandry*," as Judge French, of New Hampshire, calls it, in his very interesting essay entitled "Observations on English Husbandry," originated on the light lands "of Norfolk county, and is known generally as the Norfolk system." And the Judge observes: "So great has been the advantage of this system that, on lands so heavy, (compact,) as to be greatly injured by the treading of sheep, movable sheds have been adopted by some of those who practice 'high farming.' These sheds are of wood, with open raftered bottoms, large enough to contain twelve sheep, and are made with wheels to push forward on movable rails over the turnip field for the double purpose of manuring the land without treading it, and of sheltering the animals. The crop is thus consumed, and the cost of drawing it off and bringing back the manure is saved. The turnips are, of course, pulled out, cut and fed to the sheep in troughs." I have said that English farmers turn their sheep into their turnip fields to eat off the crop. But the sheep are not put there and allowed to run all over the field just where they please and as they please—far from it. Their sheep are enclosed and confined within or inside of movable wooden fences, called hurdles, so as to keep the sheep from rambling about, and make them stay long enough upon a certain part of the field to manure it properly for the succeeding farm crop, to wit, barley. When the sheep have, in this way, manured one part of the field sufficiently, they are removed to another part of its turnip crop until the whole field has undergone this process of sheep-feeding and soil renovation.

Joseph Harris, of New York, in his valuable essay "On stall-feeding cattle and sheep," says:

"In fattening cattle and sheep it is a question of the first importance what food is produced at the least expense to the fertilizing elements in the soil. One great object in feeding animals is to enrich the land, and it is important to know what food can be produced that will injure the land the least and enrich the manure heap the most. When the crop is favorable, there is no crop so valuable in this two-fold view as the turnip. It is cultivated in rows, which admit the use of the horse-hoe, and the plants are thinned out by the hand-hoe, about a foot apart; the land, therefore, is made very clean. It is essential, indeed, to the success of the crop that the land should be made very mellow and kept scrupulously free from weeds during its growth. It takes the place, indeed, of the old-fashioned summer fallow, and for this reason is called a fallow crop. Then a large amount of food is produced on an acre at comparatively little cost to the soil, and the consumption of their food produces a large quantity of excellent manure."

Now, this may, indeed, be true when the crop is favorable; but then it is so often unfavorable, or, in other words, a failure with us here in America, that R. L. Allen says:

"The value of turnips to this country is trifling in comparison with that of many parts of Europe. In Great Britain alone this value probably exceeds one hundred million of dollars annually. But its culture here is much less desirable, as our drier climate and early and severe winters are not as well adapted to its production and economical preservation and feeding as those of England, and its numerous enemies render it an uncertain crop. These objections are increased by the important fact that it enters into competition with Indian corn, which generally gives a certain and highly remunerative return. It may sometimes, however, take the place of corn with advantage, and the turnip or some other of the root crops should always occupy a conspicuous place as a change, in part, for the winter food of cattle and sheep."

Our climate seems to be too hot and dry for the successful cultivation of turnips on a large scale. Experience has shown that turnip seed sown in between the hills of our growing corn plants, at the last working or hoeing of the corn, is an admirable way of securing a turnip crop. For the growing corn not only screens the young and tender turnip crop from the heat of the sun and from the withering effects of drought, but also protects it in a good measure from the ravages of bugs and flies. When the corn is removed from the ground the turnips will be able to bear and have the full benefit of the sun's diminishing heat, and continue growing nicely until their growth is checked by our severe autumnal frosts. But whether the turnip can ever be successfully grown here in our country as a regular rotation farm crop remains to be seen, and if it can, it must have its place in a rotation that does not displace our Indian corn. For, as Judge French very beautifully as well as truthfully remarks in his essay aforesaid—

"No system of husbandry which should exclude Indian corn from its place in the rotation of crops can be adopted in this country. It is the golden harvest of our land, the surest gift of the great Giver to our western world. For man and for every animal upon the farm it stands at the head of the list of cereal plants. As a fodder plant, green or dry, it may take the place of almost any other."

2. SPURRY, (*Spurgula arvensis.*)—Spurry is an annual plant extensively cultivated in Germany and in France as a winter pasture for cattle, sheep, and hogs, and milch cows and sheep fed on it yield, according to Von Thaer, of Germany, superior milk, butter, and mutton. For winter pasturage it is usually sown broadcast on the harrowed stubble of grain crops just removed from the ground; but it may be, and often is, sown in the spring for spring and summer pasture. It is most admirably adapted to sandy soils, so much so that it has been called "the clover of sandy lands." It will grow well upon sandy soils that are too poor, dry, and thin to bear clover, and will also, if sown in March, and then again in May, and afterwards in July, produce three crops upon the same field in one season. These three crops will, if *successively* ploughed down to the depth of three or four inches, renovate or strengthen a poor or barren soil to such a degree that it will now bring clover or a crop of winter grain. Hence, spurry is largely grown in Belgium, Germany, and Denmark as a fertilizer, and also as a valuable forage for cattle both in its green and in its dried state. Van Voght, of Germany, is an enthusiastic admirer of it, for, in speaking of spurry, he says:

"It is better than red or white clover; the cows give more and better milk when fed on it, and it improves the land in an extraordinary degree. If the land is to lie several years in pasture, white clover must be sown with it; when sown in the middle of April, it is ripe for pasture by the end of May. If eaten off in June the land is turned flat, and another crop is sown, which affords pasture in August and September. This operation is equivalent to a dressing of ten loads of manure per acre. The blessing of spurry, the clover of sandy lands, is incredible when rightly employed."

Spurry is a hardy plant, and grows spontaneously in our middle States, as it is a native of this country, as well as of Europe. There seem, however, to be several varieties of spurry—that just described, and the Spergula maxima, the large or gigantic spurry, as it is sometimes called on account of its size, besides other varieties. The gigantic spurry is a native of Courland and Livonia, in Europe, and is likewise an annual plant, which grows as rapidly as the

common spurry aforesaid, and when about a foot high it throws out five or six, and at times as high as ten side-shoots or branches, and easily yields two crops per year, crops much heavier than those of the common spurry. It is at the same time equally as good as that for pasture and hay and as a soil-renovating manure. It forms a very early as well as a very late pasturage, and succeeds best upon sandy soils, but will grow vigorously upon other soils, and also on good soils, provided they are not too rich. It may be sown in the spring summer, or autumn, but its seeds ought to, be occasionally renewed, as the cro has otherwise a tendency to deteriorate.

3. SANFOIN, (*Heydysarum onobrychis.*)—Sanfoin is a native of and grows well on the chalk soils of Europe, as high as the fifty-first degree of north latitude It delights in high, dry, naked, white, deep, and strong chalk soils, and binds thei loose particles together better than any other plant, as its roots penetrate to a great depth, and as well as otherwise improve their condition. It belongs t the *Leguminosa* family of plants, and experience shows that it will grow wel on limestone soils, and on non-limestone soils if heavily limed. On favorabl soils it yields large crops of fodder, which though less abundant per acre tha those of lucerne, are superior both in their green and dried state to lucern fodder. Grimaldi, of Italy, assures us that in Calabria it forms an excellen crop to fertilize and alternate with wheat, and that, after the wheat is cut an removed, the sanfoin will, from self-seeding, immediately cover the ground agai with a thick turf, and continue doing this upon the same ground for forty year or more, and so manure and secure a fine crop of wheat every second year i all that time. Arthur Young, of England, also describes sanfoin as being "on of the most valuable plants ever introduced into the agriculture of Great Britain,' where it is usually mixed and sown with other seeds. Jethro Tull, a ver distinguished English agriculturist and agricultural writer, in speaking o sanfoin says, "Any dry ground may be made to produce this noble plant, b it ever so poor; but the richest soil will yield the most of it and the best.' Tull grew his sanfoin in drills, and was careful not to cover his seed over hal an inch in depth, or sow it thickly, particularly on poor land. Sanfoin is gen erally sown in the spring, but sometimes early in autumn. Its seed is wort more per bushel than oats, and is hardly inferior to peas as a food for domesti animals. Our national Agricultural Department, about ten years ago, intro duced into our country from France two varieties of sanfoin, known as "th common sanfoin, the double-bearing sanfoin," both of which are perennia plants. The common sanfoin is best adapted for poor soils, and only yields on crop a year, while the double-bearing sanfoin, which is hardier and more vigor ous, yields two crops a year, but requires a good soil; for if sown upon inferio soils it is apt to deteriorate and die out, and, therefore, must on such soils b occasionally resown thickly, with new or fresh seed, as seed a year old or olde is not sure to grow. The growth of sanfoin has often been attempted in ou New England States, but so large a portion of the crop has always been winte killed that its cultivation there is now, I believe, pretty generally, if no altogether abandoned. Its success in Pennsylvania and our other middle State has not been sufficient to bring it into competition with our red clover. It growth in our southern States seems to have been so sickly and puny as t discourage its cultivation there.

4. WHITE LUPINE, (*Lupinus albus.*)—The stem, leaves, and seeds of th white lupine form an excellent fodder, both in their green and dried state, fo farm animals, and particularly sheep. Its seeds are sometimes used as a huma food by the inhabitants of southern Europe, as they were also by the ancien Romans. The chief value of this plant, however, consists in its excellence a a green manure for the renovation of old and worn-out soils and the improvemen of soils that are naturally barren. It grows up rapidly, suffers but little fro drought, and nothing at all from insects in Europe, extends its roots more tha

two feet deep into the soil, and has numerous large roots, stems, and leaves which abound in potash, nitrogen, and phosphoric acid, three of the most valuable fertilizing elements, and hence is regarded in Italy, Spain, southern France, and parts of Germany, as being the best of all green vegetable manures, almost equal to barn-yard dung. What renders it still more valuable is the fact that it will keep down weeds, and grow in all soils except such as are marly or calcareous, and delights in all such as have ferruginous subsoil or oxide of iron. It thus not only enriches, but, through its strong roots and stems, opens and mellows up stiff clay ground. It is also one of the best green manures to bring unfruitful and sandy lands into a productive state. Its roots and stems, when imbedded in the soil, decay slowly, but their decay may be hastened by a top-dressing of caustic lime. Its success in renovating the soils of Europe has been great, for it is said, even in the north of Germany, to yield from ten to twelve tons of green vegetable matter in from three and a half to four months from the time its seeds are sown. Its seeds, which are about the size of peas, are expensive, and should be sown as early in the spring as possible without injury from frost, and will blossom in about three months or sooner, soon after which the crop should be ploughed down. It may then be very advantageously followed by most of our field and garden crops. This and all other lupines, however, belong to the *leguminosa* order of plants, and are annuals, and so must be sown or planted anew every year. The virtues of the lupine were well known to the ancient Romans, for Columella, their ablest agricultural writer, in speaking of it, says:

"Of all leguminous vegetables the lupine is that which merits most attention, because it costs least, employs least time, and furnishes an *excellent manure*." Armstrong says of it: "The properties which recommend it as a manure are nearly the same as those which belong to buckwheat. It is a quick grower, and has numerous large and succulent leaves. While growing, it subsists principally upon the air, and when buried decomposes entirely and rapidly."—(Armstrong's Treatise on Agriculture, page 661.)

In 1856 I received a package of white lupine seeds, which resembled large grains of white corn, from our United States Patent Office, and planted them carefully in a nicely prepared loamy soil; but after coming up and growing very prettily, and throwing out beautiful blossoms, my plants gradually withered away and died without ripening any of their seeds. My second trial of their seeds, in 1857, proved a still greater failure. We also learn from the Rev. C. W. Howard, of the State of Georgia, that this lupine proved an entire failure in Georgia; for although their seeds germinated and grew vigorously there, yet their seeds or beans were, soon after their formation in the growing plants, attacked and utterly destroyed, after repeated sowings or plantings, by some insect that destroyed the seeds alone and injured no other part of the plants.

5. Yellow Lupine, (*Lupinus luteus.*)—The yellow lupine, so called after the yellow color of its seeds, is also extensively cultivated in Germany and some other parts of Europe as a green manurial crop, and its culture is nearly the same as that of the white lupine, just described. It grows, according to soil, from three to four feet high, and is the only lupine out of eighty-three species whose blossoms have a sweet, honey-like smell. Its green and growing stems and leaves absorb large quantities of carbon, nitrogen, and other fertilizing elements from the air; but it is said that the fertilizing power of this and the white lupine, and other lupines, is transient, and does not extend beyond one year or season. Large crops of the yellow lupine are also grown in Europe for its seeds, which, when ground or crushed, make an excellent food to fatten cattle and hogs. For additional information as to the character, cultivation, and uses of the lupines as a green manure, see Louis Schade's statements in the Agricultural Report of 1861, pages 370–3. There is also a blue lupine (*Lupinus angustifolius*) considerably grown in Europe for green manurial purposes.

6. VETCH, TARE OR FITCH, (*Vicia sativa.*)—The vetch, tare or fitch also belongs to the leguminous or food-bearing order of plants, as its seeds are somewhere between a pea and a bean. It consists of two varieties, a spring and a winter variety, both of which are hardy and productive. But as they, too, are only annual plants, they must be sown afresh every year, a circumstance that renders their cultivation more troublesome than they otherwise would be. The vetch delights in a clay soil, but grows well on any rich soil that is not dry. It is much cultivated in Europe for green fodder or soiling, and also as a pasturage, and for cutting and curing into hay. Its seeds are generally sown broadcast on the ground and harrowed in like wheat. The summer vetch may be sown, at any rate, from the end of March till the end of May; the winter vetch must be sown in September or October, and forms in early spring a very valuable food for cattle and sheep. The vetch is often sown in stubble ground, and ploughed down as a green manure in southern Germany after it has commenced decaying in autumn through the action of frost. So the winter vetch has been found highly advantageous in England when ploughed down in early spring for manurial purposes. The vetch is not only more precarious, but also a more expensive manurial crop than either spurry or the white or yellow lupine, and also requires a better soil than they do for its successful growth. "A. S. L.," of Breedsville, Van Buren county, State of Michigan, in giving us his experience in 1859 of the vetch crop and its various uses, says:

"The vetch is considered in England as about the most valuable of her numerous green crops. For some years after its introduction here (Michigan) it suffered so severely from the attacks of a certain bug that farmers became discouraged. But I was glad to see, a short time since, a poor Irishman becoming independently rich by persevering to raise and save the seed of a few pods, which his sister smuggled to him in a letter, until by the steady increase of his store he was enabled to supply all the livery and private stables of the city near which he lived, finding a pressing demand for it at ten cents each for small bundles of about the size of oat-sheaves. Its advantages I look upon to be at least four-fold. 1. As there are two classes of seed. the winter and spring, the farmer, by sowing his first crop in October, and his second, third, and fourth in April, May, and June, can have a regular succession for the entire spring and summer. 2d. Its flavor appears to suit the taste and appetite of all herbaceous animals. 3. Its being more astringent, or less laxative or cathartic, than all other green crops, it not only increases the milk of cows, but improves their condition in an incredibly short time; and, 4, what I consider its greatest desideratum, is the safety with which hard-working and fast-going horses may use it. And when we consider the length of our winters, during which a stage-horse, for instance, is kept in hard condition on dry hay and oats, and not allowed any soft food of any kind lest his wind should be impaired, we must say, being the earliest and least flatulent, it deserves to rank first of its class. It grows in any soil, the richer, of course, the more luxuriant, is sown as wheat, and yields two crops, like clover."

And in 1860 he continued his remarks as follows, to wit:

"Last October, in reply to one of your inquiries, I sent you a few lines relative to vetches, since which I have had many letters asking where seed can be had, what soils are best suited to it, &c. It has long been a matter of astonishment to me that American agriculturists are so careless about green crops, which comprise such a serious portion of the English farmer's care. And as the annual profit of the stock of any sized farm should ever be more than double its other produce, if the proprietor but knew the value of manure and wished to proceed at the rate of holding out, I cannot at all account for the neglect of it by a people so very shrewd in matters of minor importance, particularly as our climate here makes summer forage of much more consequence to us than those so favored by constant showers. The pastures of our wealthier landholders being invariably parched, and the cattle of our poorer having little to induce them to return home from their rambles in the woods, might, one would suppose, be sufficient reasons to remind each of these classes to guard against such vital inconvenience and loss, by a system requiring such little space and such trifling expense as green-cropping—a system, too, that their own forefathers *had* followed, and their descendants at home (Europe) *do* pursue and will stick to so long as they imagine themselves to be farmers, even though their pastures are always green and their cattle never permitted to range beyond their own farms. Of green crops there are various descriptions, all in great use in every European country; but vetches appear to me to be the most nutritious and lucrative, &c. They will grow on any description of land, yielding, of course, in proportion to its richness; may be mown three times, June, August, and October; but as the present price of their seeds is the only thing which I can see preventing their general use, I would

recommend sowing at the rate of two bushels per acre, mixed with one peck of rye, cutting the first crop when two feet high, and allowing the second to ripen for seed, of which twenty bushels per acre should be the average expectation in this country. As from all I can hear of its success in Canada, where it is now a favorite forage, it yields, according to management, from fifteen to twenty-five bushels of seed, besides a valuable crop of straw, of which cattle are extremely fond. To prevent its destruction by bugs, with which American soil abounds, the seeds should be steeped for a very short time in salt and water, and then mixed with wood ashes sufficient to make it dry enough for sowing. For the purpose of procuring seed, so that the farmer may not again be obliged to purchase, the winter and spring variety may both be sown in April; but the proper time for the winter variety is early in October, and the manner of putting in each is precisely similar to those of winter and spring wheat. I know of no forage so magical in its effects on the coats and condition of horses, bringing almost the dead to life in an incredibly short time, or one so refreshing to delicate new milch cows which may have passed a hard winter. Young calves, too, will fancy themselves yearlings before the fall if regularly supplied with it, and brood-sows and little pigs will thrive upon it well; but much as I admire it, I do not wish any one to suppose that I forget the advantages of other green crops. Lest any should suffer from an adverse season, every farmer should have several patches of rye, Italian rye grass, clover and corn sown thick and broadcast, that he may be able to spare his pastures, shade his cattle during the scorching heat of the noonday sun, and raise a mound of manure which time will prove the value of.

"A. S. L.

"BREEDSVILLE, *Van Buren county, Michigan.*'

Now, if these statements of "A. S. L." be true, and we have no reason to question his veracity, the vetch is certainly a green crop that deserves far more attention from farmers in our country than it has yet received; and its manurial powers must also be great, as the vetch is a plant that absorbs a large amount of nitrogen and other fertilizing elements from the air in growing.

7. RAPE, *(Brassica campestris olifera.)*—Cole, colza, or rape is a species of cabbage, whose stems and leaves form an excellent fodder for animals, and whose seeds yield an excellent illuminating oil, nearly equal to sperm oil, and very useful to the arts. It is so hardy a plant that it will grow pretty well even in a poor soil; and it possesses the advantage of growing very late in autumn, and of beginning its growth again very early in the ensuing spring, and thus, in its thick and succulent stems and leaves, furnishes a valuable fodder for cattle at a season of the year when fodder is scarce. But it succeeds best only upon soils that are rich, deep, and dry, especially upon such as are mellow and marly or calcareous. Its planting, growth, and culture are like those of our other cabbages. But, to insure a good crop of rape, the soil must be thoroughly ploughed and harrowed, and the sown or drilled seeds well rolled down with a roller. The rape plants can be transplanted into wheat, rye, barley, and oat fields after their crops have been cut and removed from the ground. But the crop can be allowed to grow where it stands without transplanting, but in such cases it will not yield well or largely except upon the very best soils. Immense crops of rape are grown in Belgium, France, Germany, and England, mostly after a well dunged and cultivated potato or pea crop, and its long and deep roots and thick stems not only loosen up tough clay soils, but when ploughed down with their rich and oily seeds manure the ground nicely for a crop of wheat or other grain.

There are two varieties, a summer and a winter variety, of colza or rape. The summer rape is mostly sown in April or in March, if the weather is favorable, at the rate of one-fifth of a bushel of seed to the acre. It suits a light soil better than the winter rape does, but its yield per acre is generally from 33 to 50 per cent. less than that of the winter rape, as it is a much more uncertain crop than the winter variety. The winter rape is sown in July, or about the beginning of August, at the rate of from five to seven pounds of seed to the acre if drilled into the ground, and a pound or two more than that quantity of seed per acre if sown broadcast and harrowed into the soil. The winter rape is sown at the time specified, that its plants may not run to seed the same season or year, which they will be very likely to do if sown earlier than that. It is

generally transplanted during the ensuing month of September or October; and one acre of rape-seed plants furnishes enough for ten acres or more of ground, where they should stand in rows, and about ten or twelve inches apart, to admit of proper hoeing or culture. The winter rape is annually harvested about the end of June or the beginning of July, and its harvesting is commenced when its pods are brown and half their seeds are of a dark brown color. The rape ripens its seeds very unequally, as its lower pods are ripe and ready to burst open before those at its top are fully grown; and if the harvesting season is wet, much of the seed is lost by its shelling out. Hence the crop should be cut when the dew is on it, and handled as little as possible. If the weather is favorable the crop is often threshed out upon cloths in the field, but if unfavorable the crop is taken to and spread out thinly over the barn floor, and frequently turned until it is dry enough for threshing, when its seeds are carefully gathered and separated from their chaff. Cattle are very fond of the pods and small branches that are broken off in threshing. The winter rape yields from twenty to thirty bushels of seed to the acre.

After the oil is pressed out of its seeds the remains form what is called "rape cake," the manurial value of which consists chiefly in the oily particles still adhering to the husk and branny parts of the seeds.

F. A. Nants, of Philadelphia, in describing the value of rape-seed, says:

"In 1822 or 1823 there was an English farmer in Salem county, New Jersey, who sowed rape seed on a two-acre lot broadcast, so as to thin out and clean afterwards with the hoe. During the fall his cows broke into the field, and, to all appearance, destroyed all the plants. The next spring, in going to look at that field, he perceived that the greater portion of the plants had come up again. So, determining to give the field a chance, he thoroughly repaired the fence round it and harvested that summer a little over forty bushels of the seeds, which he got crushed into oil in Philadelphia, and obtained three gallons of oil per bushel of seed, or one hundred and twenty gallons, which he sold immediately at $1 30 per gallon in cash, thus realizing $156 cash from the two acres for the oil alone; for he got about one ton of rape-cake, which would now be worth about $40 as manure, as rape-cake makes an excellent manure, as good as guano, and superior to it, as it is more permanent or lasting."

8. Borage, (*Borago officinalis.*)—The common borage is an annual plant, with a rough stem and rough alternate leaves. It grows from one to two feet high, blossoms all summer, and has many flowers, mostly of a sky-blue color. Lampadius, of Germany, has recommended this plant very highly for green manurial purposes. He informs us that, in an experiment made by him with this plant in 1824, in growing a borage plant for a period of five months, to wit, from the 3d of April to the 6th of September, he at the end of that time found it, on examination, to contain ten times as much vegetable or organic matter as the soil in which it grew had lost during that same period; or, in other words, that it had drawn nine-tenths of its carbon from the air, and therefore was admirably fitted, as a manure, for improving and enriching the soil on which it is grown. Some persons may, perhaps, consider it a mere fancy, or, what is worse still, utter nonsense, to suppose that growing plants have the power of absorbing certain elements from the air, and of retaining those elements there within their own tissues. But many carefully conducted experiments with growing plants besides that of Lampadius, here given, have long since placed this power of growing plants beyond all doubt. The truth is, growing plants are not only greatly affected by the moisture and dryness as well as temperature of the air, but also derive much, and in some cases most of their nourishment from the air.

9. French Clover, (*Trifolium incarnatum.*)—French crimson or scarlet clover is a native of Italy and much cultivated in France, and hence its name of French clover. It is an annual plant, and very beautiful when it is in blossom, as its long heads of bright scarlet flowers then resemble a field of large, ripe strawberries. Its seeds differ from those of our common red clover in their being enveloped in a sort of down, that enables the winds to bear them up and

float and scatter them over the adjoining fields. On rich land this crimson clover thrives well during winter, and affords an early and valuable pasture in the spring; so it forms a valuable fertilizer when sown with wheat on good land. But it does not seem to do well in our country, though repeatedly introduced and tried. As it must be sown afresh every year, on account of its being an annual plant, it is not near as valuable as our red clover. The Neapolitan clover resembles the French clover closely, but its seeds and plants are somewhat larger than those of the French clover, and being mere *annual* plants also, are of small value on that account when compared with our red clover.

10. OTHER EUROPEAN PLANTS.—The other most commonly used green manurial plants of Europe consist of red clover, white clover, buckwheat, rye, peas, beans, and old grasses of various kinds. But as they are either just like or very closely resemble our own American plants of the same name hereafter described, I will not describe them here under this head.

3. AMERICAN GREEN MANURIAL PLANTS AND GRASSES.

1. RED CLOVER, (*Trifolium pratense.*)—Red clover, both in its green and dried state, contains a large proportion of lime, magnesia, carbonic acid, and potash, and also considerable quantities of phosphoric and sulphuric acid, chlorine, and nitrogen, and hence its value as a manure.

As a plant it has numerous and strong stems branching upwards and sideways from a single seed or root, and broad, succulent, and shady leaves, and long, thick, and strong tap roots. When we consider that it is a very hardy plant, tillers well, covers the ground thickly, displaces weeds, extends its roots more deeply into the soil than any of the grasses, yields largely to the acre, absorbs much and most of its fertilizing gases of carbonic, phosphoric, and sulphuric acid, chlorine, and nitrogen, or ammonia, from the air, and also grows well on every variety of dry soil, we need not wonder at its great celebrity as a manurial plant in our northern and middle States. Its stems, leaves, and roots, when ploughed down as a manure, not only render the soil porous, mellow, and permeable to heat, air, and moisture, but also in and by their decay draw the fertilizing saline and mineral elements of the subsoil up into the surface soil, and so enrich and fit it for the production of all other valuable farm crops, such as wheat, corn, and the like. The wheat and corn grown on clover lays are generally more free from disease and larger in their yield and better in their quality than those grown on or with animal manure. But red clover has still further excellencies. It requires but little labor to put it into the ground, and when there it demands no care, while it will produce two or more years' growth of clover from this one sowing, and if not too closely cropped or pastured maintains itself pretty well in the ground thereafter by self-seeding, and will, during all this time, also supply its owner with good hay and pasturage for his cattle, and renew his stock of clover-seed with some to spare, and still, in the end, make him the cheapest and one of the best and least troublesome manures yet known for improving and sustaining the fertility of soils. One square yard of growing red clover will, in an ordinary season, from the 1st of April to the 1st of September, yield from two to three pounds weight of tops and roots, and if we multiply this by 4,840, the number of square yards in an acre of ground, and divide the product by twenty hundred, a ton's weight, we shall find that the clover tops and roots grown on an acre of ground between these two periods of April and September will weigh from five to seven and a fourth tons of rich vegetable matter, all ready too, without any hauling, to be ploughed down as a manure just where it stands. A well-set clover lay imparts to the soil as much strength as ten or twelve loads of barn-yard manure to the acre will. Hence our wisest farmers never sow wheat, rye, or oats without accompanying it with clover-seed to form manure for their after crops.

Some farmers do not mow or pasture this manurial crop at all, and so, perhaps, go to extremes in that way; while others, and indeed most of our farmers not only make all the hay they can out of it, but let their horses, cattle, sheep, and hogs eat off its after-math *so closely* as to leave but little vegetable matter to be ploughed down for manure, and so go to the other extreme, but this extreme is far the worst of the two, and therefore should be carefully avoided; if our animals are allowed to run over and eat off the first year's crop of clover, it will, on the approach of winter, stand so thin and bare that it will be winter-killed, or at least yield but an indifferent crop the second year.

The best way, evidently, is to let the first year's growth of clover fall and decay on the ground, or pasture it but lightly in autumn, and then cut off the first crop of the second year for hay, and top the second crop for seed, and plough down its after-math, or plough in the entire second crop after it has partially ripened its seed, and so let it carry with it a full supply of seed for future growth. The great value of a clover lay as a manure for wheat and corn is well known. But most of our farmers still continue the mowing and pasturing of it until the clover is nearly run out or gone, and therefore need not wonder if their wheat and corn crops are light, and their soil is becoming less productive. Another great error in our husbandry is that our clover lays are allowed to stand too long before they are ploughed down. Some plough it down the first year of its growth, others the second, and others the third year, and others again not until the fourth or fifth year of its age. But as clover is a biennial plant, or one that continues itself on the ground for two years only when allowed to ripen its seeds, and the ground is then (if the seed, when sown, sprang up regularly and well all over the ground) generally so full of roots as to check its further accumulation, and the crop can, at best, only partially maintain itself afterwards by self-seeding, it is evident that the greatest benefit derivable to the soil from a clover manure is attained the second year, and therefore it ought to be ploughed down the second or the third year at least.

The red clover plant is supposed to be of European origin. It was, as we have already seen, extensively grown as a soil-fertilizer in Flanders three hundred years ago or more, even before the first white man's settlements were made in our country. There are two kinds of red clover—a large and a small variety; the largest is not only the hardiest but the most profitable for manurial purposes.

2. White Clover, (*Trifolium repens.*)—The white clover, as its botanical name imports, is a small three-leaved, creeping plant, with small and beautiful white blossoms. In fact, all of our clovers, whether red, white, or yellow, are trefoil—that is, three-leaved plants. Our clovers are, strictly speaking, *no* grasses, as they all belong to the leguminous or pod-bearing order of plants. The white clover consists of several varieties, all hardy, nutritious, and self-propagating; for, wherever they have once grown, their scattered seeds will spring up thickly and vigorously as soon as they have a chance to grow. But they are partial to and grow most luxuriantly upon clay soils, possessing a rich vegetable mould on their surfaces. Their dwarf character unfits them for the scythe, but their dense, sweet, and rich herbage, ever growing and ever abundant, forms a constant and most valuable pasturage for all animals. It is not grown for a hay crop, as it shrinks too much in drying, and when dry does not contain as much nutritive matter as the red clover; but it makes a valuable green manure, although it is neither so deep-rooted nor so large a yielder of stems and leaves as red clover. The British farmers consider it of so much importance for this purpose that they sow large quantities of it annually. It would be well for our own farmers to sow it pretty extensively as a green manurial crop, and particularly so upon barren fields and on rolling grounds and hill-sides, as its herbage will prevent the fine soil of high grounds from being washed away, and will also keep the ground fertile for producing superior crops of wheat, rye, oats, and

corn, if it do nothing more. Its seeds might also, like those of red clover, be sown broadcast over our corn-fields at the last cultivating or working of our corn crop, and answer very well there as a manure for the next regular farm crop whatever it be. Some farmers tell us that this sowing of clover-seed among the growing corn plants "fails three times where it succeeds once." But this clover-seed sowing among growing corn plants will succeed oftener than it fails if the work is properly done; at all events, it is worthy of more extensive and of more careful trial than it has yet received from farmers. To render our white clover still more useful, it should be mixed and sown with some of our grasses.

3. BUCKWHEAT, *(Polygonum fagopyrum.)*—Buckwheat straw contains considerable quantities of lime, magnesia, potash, soda, and phosphoric and sulphuric acid, and hence its value as a green manure. It grows up rapidly on almost any soil where other plants would starve, as its large spreading top draws more nourishment from the air than it does from the soil; and hence, it can be successfully grown on the same ground for years in succession without exhausting its soil. So its large branching top protects the soil from the scorching influence of the sun, and shades it so thickly as quickly to smother and eradicate all foul and noxious weeds; and when it is ploughed down it not only decomposes rapidly and so forms a good manure, but also loosens the soil, and thus renders it permeable to heat, light, and moisture. But, to attain its full benefits as a manure, it ought to be sown early in the season, and top dressed with lime or plaster, and ploughed down when it is in full blossom. It blossoms so much earlier than most other plants that two crops of it can, if necessary, be grown and ploughed down on the same ground the same season, and the ground be seeded down with grass or a grain crop in September. It thus operates at once both as a cleanser and a renovator of the soil.

Considerable quantities of buckwheat are sown annually in Germany and in France as a fertilizer. A French writer, in noticing buckwheat, says:

"We cannot too much recommend, after our old and constant practice, the employment of this precious plant as a manure. A small quantity of seed, costing very little, sows a large surface and gives a great crop; when in flower (blossom) first roll and then plough it in. Its shade while growing destroys all weeds, and itself, when buried, is soon converted into vegetable mould."

William Bacon of the State of Massachusetts, says:

"Buckwheat is considered a noble warrior for contending with the Canada thistle, which has for years been pushing its conquests in many parts of our northern States. An enterprising farmer has recently informed me that three years since he had a field completely overgrown with this vile plant, which flowers in spring, and again at sowing time, early in June. His first crop of buckwheat more than paid for the labor twice over, and a diminution of thistles was very evident at harvesting. The next season he gave two ploughings, as before, which kept those whose roots yet remained in the background, and in autumn he harvested a still better crop of buckwheat, while he saw his thistles rapidly running out. This year (1847) he has pursued the same course of two ploughings and sowings, and had the best crop of the three years. He said that at the last harvesting he did not believe that a dozen thistles could be found in the field. The reason of the matter is this: the two spring ploughings kept the thistles back, and the growth of the buckwheat is so rapid that it shades the *land* before they can overcome their stunted condition, and they have no territory to grow in and no sunshine to aid their growth, so they must die."—(Ag. Report, 1847, page 355.)

Again, Mr. Bacon says:

"Buckwheat's fine effects in cleansing land from weeds by its great shady tops and the pulverizing influence of its roots in the soil are enough to recommend its culture on many lands if there was no other consideration. A farmer of my acquaintance recently bought a field so densely covered with *hard hack* (Potentilla) that it looked like a barren waste. It was bought cheap, of course, for, with the incumbrance, it was worth but little. Early in the spring he commenced ploughing it with a stout team, which tore out the bushes, which, when properly dried, were burnt and the ground sown to buckwheat. The avails of the crop more than paid for the labor, and he expects the next

crop will more than pay for the land, thus giving him a good field at a cheap rate, besides beautifying and making productive one of the waste places of the earth. In two years more he will have a beautiful clean sward, where, a year ago, the eye could only rest with pain. This is not a solitary instance: we have many such, where fields are being reclaimed and subdued to the production of less hardy crops by the influence of buckwheat."—(Ag. Report, 1852, page 151.)

4. RYE, (*Secale cereale.*)—Rye is a sure and excellent manurial crop for sandy grounds, and is preferable to clover on poor soils, as it will grow on soils too poor to produce clover. But it is too shallow-rooted, and otherwise defective, to bear a comparison with clover as a manurial crop on lands that will grow clover. The rye intended for manure is usually sown in August, or about the 1st of September; its grown crop not only furnishes a fine autumnal pasturage for all farm animals, but protects the soil of our rolling lands from being washed away by heavy rains and melting snows, and forms, in its remains, a pretty good manure the next season for a late sown crop. So rye may be, and sometimes is, sown for this purpose among the growing corn, at the last working of the corn, to good advantage. Rye is grown very advantageously as a green manurial crop in Germany and in Northern Italy. Von Voght, of Germany, considers it the best of all green manures for sandy soils. It is a better soil renovator than oats, as the roots of the rye are thicker and extend deeper into the soil than those of oats do. But rye is the most expensive green manure crop of the two, on account of the high price of its grain or seeds.

5. OATS, (*Avena sativa.*)—Oat plants ploughed down as a manure also renovate the soil. Lands too poor to grow clover have been brought into a clover-bearing state by simply growing thereon, and ploughing down, two crops of oats the same season—an early and a late crop.

6. CORN and CORNSTALKS, (*Zea maize.*)—Indian corn sown broadcast over the ground and ploughed down when at a suitable height is also a good soil renovator. So are the ripened cornstalks, for these, as well as the growing stalks, contain a very large proportion of silica, lime, potash, soda, and phosphoric acid, besides considerable quantities of magnesia, chlorine, &c.; and hence their value when returned to the soil as a manure. Green and ripened cornstalks, when ploughed down, not only restore these valuable fertilizing elements to the soil, but also render the soil light, porous, and mellow. Some western farmers, after gathering the ears of the corn, rake the cornstalks together and burn them; but this is just as wasteful and injurious a practice as the burning of straw is, and for precisely the same reason, and so ought to be abandoned. C. W. Babbit, of Woodford county, Illinois, in contrasting the ploughing-down system with the burning system, says:

> "A short distance south of this (Metamora) resided two farmers, one of whom every year gathered up his cornstalks and burnt them, and also burnt over his stubble-field before ploughing. The other never allowed a stalk nor a straw to be burnt on his land, but always ploughed them under. After some fifteen years had elapsed, the farm of the former yielded, on an average, some fifteen bushels of corn less to the acre than when he commenced cultivating it, while that of the latter produced as abundantly as at first."—(Agricultural Report, 1855, pp. 151–'52.)

This accords fully with the principles of vegetable philosophy.

7. BEANS, (*Phaseolus vulgaris*)—Beanstalks or haulms contain a very large proportion of lime, potash, carbonic acid, and chloride of sodium, and considerable quantities of magnesia, soda, phosphoric and sulphuric acid, and nitrogen. Hence their great value as a manurial crop when ploughed down, as their large and rough leaves draw a large amount of these fertilizing gases from the air, and so impart to the soil far more strength than they received from it. Beans, as a field crop, yield from twenty to forty bushels per acre, according to the condition of the soil and their culture, and are worth from $1 to $2 per bushel, as they form a coarse but very nutritious and wholesome food for man. They require a warm and dry sandy or loamy soil, but also grow very

well on clay ground. The bush beans are the best for a field crop, and of these the white-colored ones are the nicest and most salable, such as the early China bean, which is a white bean, of a round or oval shape, with a bright red eye, very early, productive, and excellent whether green or dry. Beans should not be planted until all danger of frost is gone, nor until the ground has become warm, as cold and wet ground is very apt to rot the seed. The seeds, if the weather be dry, and especially if you intend planting them on poor, sandy, and gravelly soils, should be soaked for several hours in soft water, and rolled nicely in ground plaster, before planting, as this preparation will insure their more certain germination and earlier growth. The seed may be planted at any time from the middle of May to the middle of June, and this in three ways—either broadcast, or in drills, or in hills. If broadcast, it will require from two to four bushels of seed to the acre, according to the size of the seeds; if in drills, the drills should be from two to two and a half feet apart, and the seeds about four inches apart in the drills; and if in hills, the rows should be about the same distance apart as the drills, and the hills from twelve to sixteen inches apart in the rows, and have five or six beans to each hill, and about two or three inches deep in the ground. And the soil should only be moderately rich, as a rich or too strongly manured soil will run the plant too much into vine, and so yield but little fruit. The best manure for beans seems to be hogs' dung, intermixed with wood ashes. The crop may be profitably grown on those portions of the clover fields where the clover has been winter killed. The beans, when ripe, may be picked off by hand, and their stalks and leaves then ploughed down as a manure just where they stand.

8. PEAS, (*Pisum sativum.*) Pea haulms or stalks also contain a very large proportion of lime, potash, carbonic acid, and chloride of sodium, besides considerable quantities of phosphoric and sulphuric acid, magnesia, soda, &c., and hence also their great value as a green manurial crop after their ripened fruit has been gathered. Pea crops not only rid the ground of weeds, but leave the soil in a light, mellow, and fine condition for wheat, which requires but one ploughing of the ground after a pea crop to succeed well. Peas will grow pretty well on dry and light soils, but do best on moist and loamy or clayey grounds, and only require about half as much work as Indian corn, and when not injured by the pea bug, are a very profitable crop, as they will yield from twenty to forty bushels of peas to the acre, worth from $1 to $2 per bushel. They make a very nutritious and wholesome food for man, and are, if boiled, very good for fattening hogs, sheep, and poultry. The most esteemed field peas seem to be the Canada field-pea, the marrow-fats, the branch pea, and golden vine pea. The quantity of seed used per acre ranges from two to four bushels, committed to the earth either broadcast or in drills, or in hills. If the broadcast form is pursued, the peas are scattered over the ground like grain and ploughed in, and rolled down hard, and should be sown thickly, for if thinly sown the plants will fall to the ground and be very apt to rot; whereas, if they stand thickly, they will hold each other up and ripen nicely. If drilled in, the drills should be from two and a half to three feet apart, and the seed from one to two inches apart in the drills, according to the size and growth of your kind planted, as peas that need no sticks will bear quite close planting; similar distances will answer when you plant them in rows and hills. The seed may, if the ground be rather dry, be soaked in urine for a day, and rolled in ashes or plaster, as this preparation will hasten their germination and growth. If the seeds are buggy, immersing them in boiling water for two minutes will destroy the pea-bug. If the peas are sown early, and cultivated freely for a few years in succession, they will become so much infested with the pea-bug that the cultivator will be obliged to abandon their culture for a time, unless he procures a supply of new seed every year from Canada, where the bug is unknown. The early sown peas, however, if they escape the bug, always yield the best crop, and can have their

haulms ploughed down as a manure for winter wheat. Peas sown after the 1st of June will, it is said, escape the ravages of the bug entirely, as the bug seems to be gone before such late sown crop gets into blossom. The best way of growing field peas is said to consist in growing them intermixed with beans, as the bean stalks afford support to the slender and trailing pea-vines. The soil should never be rich or strongly manured, as this will cause the peas to run much into vine at the expense of their fruit. Pea crops are also liable to mildew, another serious drawback, and hence red clover is much the best manurial crop on all soils that will produce clover. Sheep and young horses may be turned into the pea fields, as a pasturage, as they relish the green-pea crop only so far as to eat off the empty pea-pods and smaller portions of the vines, and so leave the most of the stems and vines for manurial purposes. These stems and vines, when ploughed down, will, as already stated, make an excellent manure for a wheat crop.

9. Cow Pea.—The cow pea of the south is altogether different from the peas grown in the fields and gardens of our middle and northern States, and is known in our southern States by the general name of cow pea, because the cows are very fond of it as a green food. The cow pea consists of many varieties of peas of different sizes, shapes, colors, and blossoms; their color being either white, yellow, greenish, gray, red, purplish red, black, spotted, &c. The white peas are preferred for table use, and the red and black for the field and cattle, and as a manurial crop, as they are the hardiest, being hardy enough to stand in the fields all winter without rotting, and thus afford an excellent pasturage for cattle and hogs through the winter season and down into late spring. The cow pea, in fact, serves the same purposes for pasture, hay and a green manure in our southern States that red clover does here in our middle and northern States. This pea crop, in its green state, forms a rich and luxuriant pasturage for all kinds of herb-eating animals, and is equally good as a hay crop, if carefully dried, and when ploughed down it makes an excellent manure to reinvigorate and improve old and worn-out lands.

The cow pea should be sown as early in the spring as the season will permit. It is sometimes sown by itself, so as to cover and occupy the ground alone; but it is more commonly sown or planted in between the standing rows of the growing Indian corn, at the last working or cultivating of the corn. The cow-pea, when grown among corn, answers the four following valuable purposes: 1, it soon shades and protects the growing corn plants from the withering influences of the sun's heat; 2, it keeps the soil on uneven or rolling grounds from washing away by heavy rains; 3, it affords, after the corn crop is harvested, a fine pasturage for all the animals of the farm; and 4, the litter or refuse parts of its vines and leaves that are left on the ground make, when ploughed down, a good manure for the soil. The cow pea is either sown broadcast, like wheat, or planted like Indian corn; when sown broadcast the seeds are harrowed in, and the ground, if very loose and porous, is rolled to make the soil more compact and firm. The quantity of seed sown or planted ranges from one to four bushels per acre. The yield of peas, when sown or planted among the growing corn, ranges from three to fifteen bushels per acre, and from fifteen to forty bushels per acre when sown or planted as a separate and distinct crop. Some regard late sowing or planting, say from the first to the middle of June, as the best, as the crop is then sure to escape the ravages of the pea bug, which is so destructive of all the earlier sown pea crops.

The cow peas are harvested in September and October, and generally bring about the same price per bushel in the south that Indian corn does. They are more easily cultivated than corn, but are more laborious to harvest. The cow pea, unless when intended for manurial purposes, is, for the most part, eaten off the ground by cows, hogs, sheep, and horses, none of the peas being gathered excepting what may be necessary for table use or as a seed for future crop. All

animals so fed or pastured will fatten very quickly. The cow pea crop is becoming unpopular as a pasturage among many planters in our southern States, from the fact that it often kills animals that feed on it in a green state. But this is often, if not always, the result of their animals eating too much of this green food, and so it may be prevented by proper care and attention. Planters who have used the cow pea crop as a green food for cattle without losing a single animal by it, say that the animal deaths complained of arose from the cattle, hogs, horses, and mules having been turned into the fields hungry; and that if they are first fed with salt in their feed, and watered *before* they are put into the pea field, there will be no danger, however long they may remain in the field.

Edmund Ruffin, a distinguished agriculturist and agricultural writer of Virginia, speaks in glowing terms of praise and of the soil-renovating powers of this pea of the south. In an address delivered by him before the South Carolina Institute, in Charleston, South Carolina, he says:

"The native southern pea, (cow pea,) of such general and extensive culture in our outhern States, is the most valuable for manuring crops, and also offers peculiar and great dvantages as a rotation crop. *It is even better than clover* as a preparing and manuring crop or wheat. Though for a long time I had believed in some of the great advantages of the ea crop, and had even commenced its culture as a manuring crop, and on a large scale, it was not until I afterwards saw its culture, growth, and uses in South Carolina that I learned o estimate its value properly, and perhaps more fully than is done by any who in this State vail themselves so largely of some of its benefits. Since, I have made this crop a most nportant member of my rotation, and its culture as a manuring crop has now become eneral in my neighborhood and is rapidly extending to more distant places. If all the adantages offered by this crop were fully appreciated and availed of, the possession of this lant in your climate would be one of the greatest agricultural blessings of this and the ıore southern States. For my individual share of this benefit, stinted as it is by our colder limate, (Virginia,) *I estimate it as adding at least one thousand bushels of wheat annually to ıy crop.*"—Agricultural Report.

10 Old Grasses.—Johnston, of England, in speaking of the effect that rowing grasses have upon our soils, says:

"When lands are impoverished you lay them down to grass, and the longer they lie unisturbed the richer in vegetable matter does the soil become. When broken up, you find a lack fertile mould where little trace of organic matters had previously existed."—Johnston's ectures on Ag. Chem., p. 59.)

Again, he says:

"Perhaps the most common form of green manuring practiced in this country is that of loughing up grass lands of various ages. The green matter of the sods serves to manure ıe after crops and renders the soil capable of yielding a richer return at a small expense of anure artificially added."—(Idem, p. 421.)

And again, he says:

"Hence, one good year of grass or clover will enrich the soil more in proportion to the me expended than a rest of two or three years in grass if annually mowed; or if, instead of eing mown, the produce in each case be eaten off by the stock, the result will be the same. hat which lies the longest will be the richest when broken up, but not in an equal proortion to the time it has lain. The produce of green parts, as well as of roots, in the articial grasses, is generally the greatest during the *first* year after they are sown, and there re the manuring derived from the droppings of the stock as well as from the roots will be reatest in proportion during the first year. That farming, therefore, is most economical, here the land will admit of it, which permits the clover or grass seeds to occupy the land r one year only."—(Idem, pp. 424–25.)

So Chaptal, a distinguished French agriculturist and agricultural writer, says:

"It is well known to farmers that by ploughing in a crop of grass, or any kind of annual ants, land is put in a state, without other manures, for the production of a crop. In this se, indeed, more is actually given back to the soil than it has itself furnished to the plants, nce these latter contain, in addition to the juices which they have absorbed from the earth, ıe various principles which they have decomposed from the water and the air during the veral stages of their growth."—(Chaptal's Ag. Chem., p. 286.)

It is evident, therefore, from the above considerations, that poor lands laid own to grass will improve and get richer and richer the longer they are kept ı grass, particularly when a large portion of their annual growth is allowed to

remain and decay upon the ground where it has grown. After these grasses have occupied the ground for several years or more, they are usually called old grasses, from their age as compared with our young or newly sown grasses. Any kind of grass, so used, will improve the soil. Some grasses, however, will, for self-evident reasons, improve soils far more rapidly and permanently than other grasses will or can. It would be well for us to know which of our numerous grasses are the best for this purpose. Our most nutritious grasses are, doubtless, also our best manurial grasses. But men of science are not yet agreed as to which of our grasses are the most nutritious. The late Dr. Darlington, of Pennsylvania, considers meadow, or green grass, as the most nutritious of all, for he ranked the eight best grasses in the following order of excellence, to wit: 1, meadow, or green grass; 2, timothy; 3, orchard grass; 4, meadow fescue; 5, blue grass; 6, ray or rye grass; 7, redtop; and 8, sweet-scented vernal grass. But Dr. Muhlenburg, of the same State, and John Taylor, a noted Virginia agriculturist, in their time, considered the tall oat grasses standing at the head of all the grasses for nutritiousness, while Fulton, of Great Britain, puts timothy at the head of all our grasses for nutritiousness, his order of excellence being as follows, viz: 1, timothy; 2 crested dog's-tail; 3, cock's-foot, (orchard grass;) 4, Italian rye grass; 5, smooth-stalked meadow grass; 6, hard fescue, &c.—(See Ag. Report, 1860, page 129.) Thus, we are still greatly in the dark upon this subject, and will remain so until far more extensive as well as accurate scientific experiments have been made upon and with our various grasses than have yet been made. When will our national Department of Agriculture turn its attention to this highly important subject of inquiry, immensely more important to us as a nation than many of the subjects that have so far filled the pages of our national reports on agriculture?

As our several grasses always succeed best upon some peculiar or particular soil, we should be very careful to sow and grow them on those soils only that are best suited to their nature and wants or vigorous growth. Thus, for example, on *dry* soils we should sow the red and white clover, timothy, orchard grass, tall oat grass, blue grass, smooth-stalked meadow, hard fescue, sheep fescue, and red and purple fescue grasses; on *wet* soils, timothy and redtop; on *clayey* and *moist* soils, timothy, meadow foxtail, smooth-stalked meadow, rough-stalked meadow, tall oat, tall fescue, and the floating fescue grasses, and blue grass; on *swampy* and *boggy* soils, the upright bent, white bent or fiorin, tall oat, meadow fescue, floating fescue, meadow foxtail, and smooth-stalked meadow grasses, as these several grasses do well or best upon these particular soils. The names of many other grasses, both old and new, might be added to this list. Hence, we see that we have grasses suited to every variety of soil, and so have no excuse for letting our fields lie naked or bare in summer, and thus exposed to all the injurious influences of a hot sun, that causes most of the soil's best fertilizing elements to pass away into the air by the process of evaporation. Therefore, all of our grain-growing fields should always, except when they are covered with grain, have a good coat of clover or of grass, so that whenever we come to plough up a field for the raising of a grain or root crop of any kind, we may have a dense mass of vegetable matter to plough down as a manurial preparation for such grain or root crop. It is just as easy, and even easier, to do this than it is to let our lands lie bare, in open naked fallows, with nothing to shade them from the sun, drying winds, and heavy washing rains but the weeds that nature may, through her own unaided efforts, cause to spring up on these fields, and trouble us to get rid of by repeated ploughings and harrowings of the ground. Farm lands, so managed, would always have an abundance of pasturage and of hay, and would never become so poor, exhausted and worn out as they now are under our ruinous, soil-destroying, naked summer fallow system, if it deserves that name. The great advantage of the reform which I have suggested is this, to wit, that we can then apply the most of ou

barn-yard manure to our meadows and pastures and keep them in a highly productive condition, instead of applying all that manure, as we now do, to our corn, wheat, and other grains, and also root crops. This suggested reform is of infinitely more importance to our country than even our best farmers are aware of, since it will, in connexion with lime, furnish us with the easiest, cheapest and best way yet known of renovating our exhausted and worn-out soils. No man, I am persuaded, need look for any decided or general improvement in our poor farms, until the various grasses, the best grasses that we can procure, are grown upon all our fields in constant and regular abundance, as here recommended. Barn-yard manure will make our meadows, pastures and grass fields produce large crops of excellent pasture and hay for the feeding and fattening of our farm animals, which will, in return, greatly increase the quantity, as well as the quality, of the animal manures, to keep up this fine condition of our meadows, pastures and grass grounds; while the green manurings will, at the same time, make the grain fields yield greatly increased and superior crops of grain and roots of various kinds. Farms so managed can go on producing abundantly, year after year, for a thousand years to come; nay more, as long as the world stands and man cultivates the earth for bread. For proof of this look at Germany, where grounds that have been under the action of the plough for the last two thousand years or more are now, through skilful management, actually producing more produce of all kinds to the acre than they were ever known to do before. What has been done with soils there can also be done with our soils here, for all that we need is a system of farming conformable to nature, and the thing is done successfully.

4. Preparation of Soil and Seeding for a Green Manurial Crop.

What I have already written will show how and when the ground should be prepared and seeded for a green manurial crop so plainly that I need not say much about it here. It is only necessary for me to say here, in a general way, that whatever a manurial crop may be, we should always use considerably more seed per acre for it than for a grain, grass or pasture crop, so that it may cover the ground with a luxuriant and dense mass of vegetable matter. Many farmers, to save a little money in the start, sow too small a quantity of seed per acre upon their grounds, which, in the long run, is a very serious loss to them. Avoid this error, therefore, carefully, and that also of sowing more seed than is necessary, which is equally bad.

5. Pasturing of Green Manurial Crop.

And now the question comes up, how long and how much should our green manurial crop be pastured? I answer, "We should never turn our animals upon these crops for the purpose of pasturing them; or, if we do, let them pasture off but little." Long experience has indeed shown that vegetable matter is more sensibly active as a manure after it has been *animalized*, or, in other words, has been eaten and passed through the body of some animal.

This *animalization* of vegetable matter imparts to it certain proportions of nitrogen and of saline elements not previously possessed by it, and hence its increased activity as a manure. Thus, for example, some very skilful agriculturists are of opinion that a green turnip or clover crop eaten off the ground by sheep or cattle will, in its remains thus intermixed with animal dung, produce a larger after-growth of wheat and corn than the whole of the green manurial crop, if ploughed down, would have done. But this advantage to the wheat and corn crop can only be secured by letting the crop be pastured off by fat or fattening animals only, in fine condition, and on soils that are not poor in vegetable matter, as poor and young and growing animals will, for manifest reasons, make too poor a dung for this purpose. Such crops, however, may be

advantageously eaten off by sheep on light and loose soils, as their treading will render such soils more compact and solid, and also imbed their manure nicely and evenly in the soil, and so enrich it. But no sheep or horses, let me add, should ever be allowed to pasture on clover, because they will bite the plants off close to the ground; and when the crown or branched top of the young clover is once nibbled off or injured, its roots will die, and the crop will speedily fail. Hence clover should never be pastured at all the first year, and but slightly, if at all, the second year. The rule of pasturing this and all other green manurial crops with farm animals of all kinds should always be, "On late in the spring and off early in autumn," so that the clover or other crop, whatever it be, may retain a large amount (the main part) of its vegetable matter for manurial purposes. Common sense will teach every man that this is sound doctrine, such as every prudent landowner will appreciate and practically adhere to for his own present good and that of his children after him.

6. Ploughing down of Green Manurial Crop.

Johnston, of England, says: "In no other form can the same crop convey to the soil an equal amount of enriching matter as in that of green leaves and stems. When the first object, therefore, in the farmer's practice is so to use his crops as to enrich his land, he will soonest effect it by ploughing them in the green state."—(Lectures on Ag. Chem., p. 418.) Again he says: "The plants ought to be mown or harrowed and at once ploughed in, before they come into flower. The flower leaves give off nitrogen into the air, and as this element is supposed especially to promote the growth of plants, it is desirable to retain as much of it in the plant and soil as possible. Another reason is that, if allowed to ripen, some of the seeds may be shed and afterwards infest the land with weeds."—(Idem, p. 422.) And again, he says: "The stems and leaves of plants are generally supposed to be richest in nutritive matter when the plant has just come into flower."—(Idem, p. 525.) Low, in his valuable work, entitled Elements of Practical Agriculture, says: "The period at which the plants should be ploughed down is just when they are coming into flower, for then they contain the largest quantity of readily soluble matter, and have the least exhausted the nutritive substance of the soil." And the British Society for the Diffusion of Useful Knowledge, in speaking of green manures, say:

> "The time of the year when they should be ploughed in must, of course, depend upon the nature of the crop, which should always be buried before it arrives at perfect maturity, or otherwise it will rob the land of that nutriment with which it is intended to supply it. * * * But the work should be done in the heat of summer, or at least early in autumn, while the sun has the power to forward the fermentation—rotting of the crop. The effect, indeed, will greatly depend upon the season, for the process of fermentation is only slight when checked by the want of free communication with the air; and if the weather be cold the power of the manure will be, in a great measure, lost; but if the season be moderately moist and very warm the fermentation will be much promoted, and the crop will be converted, by putrefaction, into a mass of nutritive mucilage. Nothing short, however, of an *abundant crop* will have that effect, as a large mass decomposes much more speedily than a small one; and if very scanty, the latter, perhaps, may not putrefy at all, or its decomposition will be so very gradual that the land will be very little perceptibly the better; but if such a quantity be turned under the earth as will excite the force of fermentation, there can be no doubt but that it will then be greatly as well as promptly benefited. * * * And there can be little doubt that the crop should be *ploughed down* as soon as it is in blossom."—(Practical Treatise on Manure, pp. 170, 171.)

A good green manurial crop will form a dense and close mass of vegetable matter, from twelve to fifteen inches high. And this, when ready for the plough should be rolled down with a heavy roller the same direction that our furrows are to run, and also be rolled in the morning when the dew is on it, as it will then roll down more evenly and nicely. And this vegetable mass should be thoroughly ploughed in, so as not to leave any part of it sticking up and out between the furrows, as such ploughing is not only slovenly, but wasteful.

7. Depth of Ploughing down.

Green manurial crops should be ploughed down to the depth of three or four inches only—just deep enough to prevent their wastage, and yet near enough to the surface of the ground to be acted on by the solar heat and air, and also afford certain, active, and constant nourishment to the young and expanding roots of our succeeding regular farm crops. Deeper ploughing down than this will, in most soils, exclude the sun's heat and the air from our green manure so much as to retard its decay, and often prevent it from furnishing timely and regular nourishment to our farm crops. Some farmers, however, are in the habit of ploughing down their green manures as deeply in the ground as they can, and the consequence evidently is, that its decaying matter cannot furnish any, or, if any, but very little nourishment to the farm crop, whatever it be, that follows such manuring, as it lies too deep in the ground to do that. Its full beneficial effects cannot be realized until another ploughing of the ground has brought its decayed or nearly decayed matter up within some three or four inches of the surface of the soil.

8. Benefits derivable from Green Manuring.

The benefits or advantages derivable from green manuring ploughed down into the soil are numerous as well as great. I will mention the most prominent benefits only.

1. It restores to the soil all of those mineral and saline elements that its growth or growing plants had absorbed or drawn from the soil, to wit, alumina, lime, magnesia, potash, soda, sulphur, oxide of iron, oxide of magnesia, &c., for growing plants absorb or suck up from the soil, through the spongioles or numerous little mouths of their roots, these and all other substances that are essential or useful to their growth, and retain them in their stems and leaves.

2. It also restores to the soil all of these fertilizing gases that its growing plants had absorbed or derived from the air or atmosphere, to wit, oxygen, hydrogen, nitrogen, carbonic acid, phosphoric acid, sulphuric acid, chlorine, &c. It is now an ascertained fact that the spongioles, pores, or little mouths on the *under sides* of the leaves of all growing plants have the power of absorbing or sucking in from the surrounding air all the above, and perhaps other as yet unknown gases that are essential or useful to their own healthy and vigorous growth. We thus, in ploughing down *the whole* of a green manurial crop, not only restore to the soil all that its growing crop had received from the soil, but, at the same time, also all, or nearly all, that it had received from the air. And so we must, of necessity, make the soil better or richer than it was before, since we really add to it more, a good deal more, fertilizing matter than the ploughed-down vegetation had taken from it. Hence, if we, in the language of Johnston, "repeat the process with a *second* crop, it (the soil) becomes richer still, and it would be difficult to define the limit beyond which the process could no further be carried."—(Lectures on Ag. Chem., p. 419.) And, as he remarks, "those soils only are beyond the reach of this process on which plants refuse to grow at all, or on which they grow so languidly as to extract no more from the air than is restored to it again by the natural decay of the organic matter which the soils already contain."—(Idem, p. 419.) But no soils are so poor that nothing at all will grow on them. If we select the plants and grass-seed best suited to their weak and low condition and sow and manure them, as best we can, with a little animal manure, we may gradually, though it be slowly, so improve those poor and barren grounds that they will at last produce a sufficient amount of vegetable matter to make them, when it is ploughed down, increase pretty rapidly in point of fertility, and then we shall be rewarded for all our labors in nursing them into usefulness. When we have once got them into a productive condition we must, as time progresses, also impart to them such animal and mineral ma-

nures as the farm crops grown on them demand, if we desire to prevent theii relapsing again into their original poor and unproductive state.

3. Green manuring ferments and decays very rapidly (especially if its mass be heavy and dense) in consequence of its soft and sappy nature, and thus produces an immediately beneficial effect upon the very first crop of grain, grass, and the like, grown upon it, or its decaying roots, stems, and leaves.

4. It makes the stems of wheat, rye, oats and other cereal plants grow up stronger and stiffer, and bear larger and heavier kernels or grains, than anima manures can produce. It has a similar beneficial effect upon our different root grass, and other fodder crops.

5. It makes the soil loose and mellow, because the vegetable matter so ploughed down becomes, through the future action of the plough, harrow, and cultivator so intermixed with the hard particles of earth as to render them softer, and gradually crumble down under the influence of the air and solar heat, into a darker-colored and porous loamy soil. I have seen a field, whose heavy, stiff cold, and adhesive clay ground here has, through the action of *green manuring* vigorously practiced upon it for several years, undergone this very change to such an extent that it surprises its owner, as well as others. The reason o philosophy of this change is easily understood from what I have already said.

6. It makes the soil warmer, because its fermenting vegetable matter acquire and evolves a *large amount of heat* while undergoing the process of fermentation and decay. That heat will, of course, render the soil everywhere considerably warmer than it otherwise would have been, and so fits many a cold soi for producing a good corn, or other farm crop, that it would, without such manuring, have been *too cold* to produce. But to secure this warmth of soil on must grow and plough down a *heavy and dense mass* of vegetable matter as such a mass only is capable of producing a large amount of heat. If w collect a thick and compact heap of weeds of any kind, say a wheelbarrow ful of purslane and such other weeds as grow up spontaneously in our gardens an out-lots, and let them lie in a mass for two or three days, we shall then b astonished to find what a heat its interior parts contain—a heat resembling, a times, a bake-oven heat. This will show us, at once, what must go on unde ground when a dense mass of vegetable matter is ploughed into the soil as manure. The ploughing down of a thin and scanty green manurial crop, how ever, will produce and evolve but little heat, and so be of but little use so fa as the warming up of the soil is concerned.

7. Its fermenting and putrefying vegetable matter either destroys or drive away insects, bugs, and worms, and so saves from their destructive ravages th various farm crops grown upon such green-manured soils. The green manuring are supposed to kill or expel these insects, bugs, and worms, partly through th heat evolved by their fermentation, and partly, and perhaps mainly, through th repulsive nature of their hot, sharp, bitter, pungent, and acrid juices containe in green vegetation. Animal manures are, on the contrary, very favorable t the production and presence of the various worms, bugs, and insects that injui and destroy our various farm crops. And hence vegetable manures are, in th point of view, far safer and better than animal manures are.

8. A dense crop of green and growing vegetation enriches the land on whic it grows merely by its covering and shading the ground. Anderson, a Scot agricultural writer, says:

> "Every practical farmer knows, or ought to know, for the facts are constantly before h observation, that land can be made exceedingly fertile without manure. He must ha noticed that if any portion of the soil has been covered, either accidentally or designedl for some time, by water, stone, plank, logs, chips, brush, rails, cornstalks, straw, buildin of every description, with cellars, hay or straw ricks, leaves, or clover, and, in fact, th under any and every substance which has covered its surface closely, it (the surface soil) inv riably becomes exceedingly fertile, and that the degree of this fertility is totally independe of the covering substance."—(See Anderson's Economy of Manures.)

This is true, and it becomes so because this fibrous covering prevents the evaporation of its moisture, and, by confining the air there, favors the accumulation of carbonic acid, nitrogen, chlorine, and other fertilizing gases of the air, which putrefy the vegetable matters in and upon the soil, and so enrich the soil and render it porous and mellow.

Now, these eight benefits or advantages derivable from green manuring are certainly sufficient to recommend the practice of such manuring to every farmer who has a proper regard for his own interests. But we have two other reasons of a peculiar nature, and connected with the practice of such manuring, that ought to make green manuring very popular among farmers of every class throughout our widespread Union. These reasons are as follows: 1. Because such green manuring can be grown upon the whole farm, field after field, and right upon the spot or spots where it is needed, and so will save all the time, labor, and expense of hauling manures for this purpose; and, 2. Because crop after crop of such green vegetable manures can be grown and ploughed down on such grounds as are too poor to yield a crop of grain or roots, until these grounds, however poor, will be able to produce good farm crops. The most barren soils imaginable have been and can be improved and made quite productive in this way, as thousands upon thousands of acres of land in Europe have shown; and what has been done there can also be done here, as the same causes produce the same effects everywhere throughout the world.

9. Why Green Manurings are Beneficial.

I have just shown that green manurings are beneficial; and now the question arises, *why* are they beneficial to our various soils and growing farm crops? I have answered this question to some extent already but I will answer it still further. That green manures will improve our soils and crops is a fact universally known and admitted, because long experience and observation have proved them to do so. But the farmers who used these manures in former times had not a sufficient understanding of the philosophy of the thing to tell us why said manures benefited their soils and crops. They knew that these manures did this, and that is all they knew about it. They had, indeed, a sort of loose and general idea that such manures, when ploughed down into the soil, did in some way or other return the soil more fertilizing matter than their growth had drawn from it; but what those fertilizing elements were was a profound mystery to them, as they did not even know their names, and had no idea whatever of their nature and properties. But while the farmers of Flanders, Germany, France, and England, and some other countries, including our own, were industriously and profitably engaged in supplying their lands with green manures, a new and a rising science, called chemistry, suddenly, and very unexpectedly, came to their aid, and taught them the *names* of the fertilizing elements of soils and plants, and also their natures and properties. Those profound philosophers and practical chemists, Dr. Sprengel, of Germany, Sir Humphry Davy, of England, and Le Comte Chaptal, of France, explained these elements of the air and of the earth for the benefit of farmers. These fertilizing elements are—I give their names here so that they may be known and remembered: 1, silex, or silica; 2, alumina; 3, lime; 4, magnesia; 5, oxide of iron; 6, oxide of manganese; 7, potash; 8, soda; 9, oxygen; 10, hydrogen; 11, nitrogen, or azote; 12, carbonic acid; 13, phosphoric acid; 14, sulphuric acid; and 15, chlorine; and perhaps a few other elements not yet ascertained with sufficient clearness. The prescribed limits of this essay will not permit me to stop and describe these elements. All I can now do is to say that we have the knowledge that such elements do exist in soils and in growing and ripened plants and grasses. Ever since this knowledge has been obtained we are able to see the reason or reasons why any particular plant or grass used for green manurial purposes is beneficial as a manure.

Thus, for example, J. Thomas Way, a distinguished English chemist, professor of chemistry in the Royal Agricultural College, Cirencester, in England has very carefully analyzed red clover, and found every 100 parts of dry or dried red clover to contain the following proportions of the above-named fertilizing elements, to wit:

Way's chemical analysis of red clover.

Silica	0.59	2.60
Lime	22.62	21.91
Magnesia	4.08	8.28
Peroxide of iron	0.26	0.46
Potash	36.45	16.10
Soda	....	40.71
Chloride of potassium	2.39	....
Chloride of sodium	1.53	4.73
Carbonic acid	23.47	....
Phosphoric acid	6.71	4.12
Sulphuric acid	1.35	1.06
	99.05	99.97

The analysis in the second column of figures was made by Horsford, a chemist of Germany, on red clover plants grown in Germany, and artificially dried previous to their being analyzed. And so we can now see at a glance why our red clover plant makes, when ploughed down, so valuable a manure as it does. We also see the reason why lime and wood ashes, the material used for making potash, are such energetic fertilizers as they are to make our red clover crops grow up rapidly and luxuriantly. All other plants and grasses make good green manures for like or similar reasons. If American farmers, as a body, had a sufficient knowledge of chemistry to understand how much fertilizing matter such green manurial crops impart to the soil, they would very soon, I am sure practice green manuring upon their farms a thousand-fold more than they are now doing.

Dr. Daniel Lee, of our own country, has very shrewdly remarked: "The raw material for making all crops being known, the accumulation of such raw material is as simple as to make brick and lay them up into the walls of a house," (Ag. Report, 1850, page 41)—a remark that is strictly correct and true. I venture the assertion, without any fear of a successful contradiction from any quarter, that green manures—such as I have already described—contain, within themselves, far more of "the raw material for making all crops" than any other manures on the face of our earth do. And are we not, in this point of view guilty of consummate folly in refusing to avail ourselves of this manure—manure, too, that we can easily obtain and grow for ourselves everywhere in rich and overflowing abundance?

10. WHAT THE BEST AGRICULTURAL WRITERS SAY OF GREEN MANURES.

Some men have such clear and comprehensive minds that they can quickly understand any new subject that is properly presented to their view, and they can and will rest satisfied with their own understanding of it. But the mass of men reason with them as clearly and as powerfully as you may upon any subject, will still say, and keep saying, "Why, sir, where is your authority for saying what you say?" just as if good reasons were no authority at all until or unless they come to us from some man of note of generally known and acknowledged abilities. As this essay is intended for the masses (for men of learning don't need it, except perhaps, to refresh their memories) allow me, lawyer-like, to quote authorities

and show our plain-minded tillers of the soil what our best agricultural writers, both of Europe and America, have said about green manurings. Von Thaer, the great German agriculturist, and most distinguished agricultural writer of Germany, in speaking of green manures, says:

"We bestow a most active and abundant vegetable amendment on soil when we sow it with plants adapted to its nature, which will flourish and attain the highest state of development, and then, when they have begun to flower, either bury them by the action of the plough, or have them eaten off the ground or trodden in by cattle. This practice is of great antiquity. It was held in high estimation by the Romans, and exists at the present day in Italy. There it is that the amelioration produced by a crop which has been buried *while green*, is the very best that can be bestowed on a soil, and is capable of bestowing on it the utmost degree of fertility of which it is susceptible; indeed, they even prefer it *when there is a sufficiency of animal manure*."—(Von Thaer's Principles of Practical Agriculture, page 229.)

Chaptal, an equally distinguished French agriculturist and writer, says:

"By a judicious rotation of crops, the cereal, herbaceous, and leguminous plants and roots, &c., succeeding each other in a properly arranged order, the soil is rendered more productive instead of being impoverished, weeds are extirpated, and more abundant crops are obtained at a diminished cost. During the years, also, in which certain kinds of fodder, such as lucerne, sanfoin, and clover, demand only the care of harvesting, the farmer may give his whole attention and employ all his manures and the labor of his cattle in the melioration and amendment of such portions of his soil as he may find in need of it, so that, instead of leaving one-third of his arable land in unproductive fallows, he may have it covered with herbage, affording an excellent product, enriching his soil in place of making it poorer, and preparing it, without other manure, for succeeding crops of grain."—(Chaptal's Ag. Chem., page 330.)

Sir Humphry Davy, of England, says:

"Land, when it is not employed in preparing food for animals, should be applied to the purpose of the preparation of *manure for plants;* and this is effected by means of green crops, in consequence of the absorption of carbonaceous matter in the carbonic acid of the atmosphere. In a summer fallow a period is always lost in which vegetables may be raised either as food for animals or as *nourishment* for the next crop.—(Davy's Elements of Ag. Chem., page 231.)

Professor Johnston, of England, from whose valuable "Lectures" I have already made various quotations, says:

"The ploughing in of green vegetables on the spot where they have grown may be followed as a method of manuring and enriching *all* land where other manures are less abundant. Growing plants bring up from beneath, as far as their roots extend, those substances which are useful to vegetation, and retain them in their leaves and stems. By ploughing in the *whole* plant we restore to the *surface* what had previously sunk to a greater or less depth, and thus make it (the surface) more fertile than before the green crop was sown. This manuring is performed with the least loss by the use of vegetables in their green state."—(Johnston's Lec. on Ag. Chem., page 418.)

Professor Way, of England, says:

"If, instead of having the land exposed only to the action of the atmosphere, we crop it with a plant whose roots run in every direction for food; and if, when this plant has arrived at considerable growth, we turn it into the surface soil, we have not only enriched the latter by the elements derived from the air, but also by matters, both mineral and vegetable, fetched up from the subsoil. The plant thus acts the part of collecting the nourishment for a future crop in a way that no mechanical subsoiling or trenching could effect. * * * Theoretically, that plant will be most adapted for the purpose of green manures which presents the largest surface of leaves for the collection of atmospheric food and sends down the deepest roots for the mineral wealth of the subsoil; and the crop which will most benefit by the supply of manure thus afforded will be that one which, besides throwing out its roots laterally, or being a shallow feeder, is at the same time most dependent on the soil for nourishment."—(Morton's Cyclopedia of Agriculture, vol. 1, p. 1005.)

The British Society for the Diffusion of Useful Knowledge say:

"Green manures consist in full crops of succulent plants, such as buckwheat, rape, tares, and many others, which are ploughed into the land, and have been applied, in many instances, with very singular advantage, more especially on calcareous, gravelly, and sandy soils, the fertility of which has been thus greatly improved. The practice dates as far back as the time of the ancient Romans, and is still continued throughout Italy, even in places where the dung of animals can be procured in abundance. * * It has, indeed, been held by many intelligent men that the lands which produce these crops will be deprived of their vegetative properties in proportion to their luxuriance; and, therefore, that, by returning the crop into the same land, its fertility can only be increased in the same degree as

it was reduced by their growth. This theory, however, can only be supported upon the principle that plants are fed more by the soil than by the atmosphere; whereas it has been shown by many curious experiments that the air and water are the chief sources of vegetation; and it is a fact that poor land without manure, which, by the fortuitous changes of the weather, has produced tolerable green crops, has been found more fertile after their production than before."—(Practical Treatise on Manures, pages 169 and 170.)

Judge Buel, of our own country, and long the editor of that distinguished agricultural journal the "Albany Cultivator," says:

"Clover will grow on pretty much all soils that have been laid dry by good drains. It is the basis of good farming on all lands susceptible of alternate husbandry. Its benefits are three-fold. It, first, breaks, pulverizes, and ameliorates the soil by its tap roots; and it, secondly, furnishes a cheap food for plants, as well as, thirdly, for animals. A good clover lay is worth to a crop, by the food which it affords, as much as five tons of manure to the acre. To insure a good lay, at least ten pounds of seed should be sown to the acre, and the ground well rolled. Its value, as food for plants, depends more upon the quantity of roots than upon the luxuriance of the stems, though the abundance of the latter will depend, in a great measure, upon the number of the former. To obtain the full value of this plant, we must cultivate it as a food for our crops as well as our cattle, and in this case we should use it as such the first or second year before it has run out. There is economy in always sowing clover with small grains, though it is to be ploughed in the same or the next season. Ten pounds of seed cost, upon an average, one dollar. The labor of sowing it is comparatively nothing. Its value to the next crop cannot be less than quadruple that sum, to say nothing of the feed it may afford, or its mechanical amelioration of the soil."—Buel's Farmers' Instructor, 100, p. 200.

Again, he says:

"Manures are a principal source of fertility; they are to our crops what hay and forage are to our cattle, the food which is to nourish and perfect their growth. Continual cropping, without manure, as certainly exhausts the land of its fertility, as constant draining from a cistern that is never replenished exhausts the water which it contains.

"The practice of some who, disregarding one of the soundest rules of farming, continue to crop, without manuring, until the soil will no longer yield a return to pay for the labor, is upon a par with that of the man who undertook to teach his horse to live without food just as the experiment was about to succeed the horse died."—(Idem, vol. 2, page 4.)

And again, he says:

"Plants are as much dependent on food for nourishment and growth as animals are; and there is as much propriety in expecting a horse to thrive at a stall which is never replenished with forage or provender, as there is in expecting a continuation of good crops from a field which is never replenished with manure. Philosophers may speculate upon what constitutes the food of plants, but the practical farmer knows that a crop is luxuriant and abundant pretty much in the ratio of the manure which is applied to the soil. The inference is irresistible that vegetable and animal manures constitute the basis of the food of vegetables."—(Idem, vol. 2 page 186.)

R. L. Allen, in speaking of green manuring, says:

"Its results have been entirely successful where steadily pursued. Lands in many of our eastern States which have been worn out by improvident cultivation, and unsalable at $10 per acre, have, by this system, while steadily remunerating their proprietors by their returning crops for all the outlay of labor and expense, been brought up in value to $50 per acre. The full benefit of green crops as manures seems only to be realized where there is sufficient lime in the soil. Calcareous soil, or such as have a large proportion of lime, however they may have become exhausted, when put under a thorough course of treatment, in which green crops at proper intervals are returned to them, are sooner restored to fertility; and when lime does not exist in the soil, the application of it, in the proper manner and quantity, will produce the same effect."—(Allen's American Farm Book, pages 73 and 74.)

Dr. Daniel Lee, in his interesting essay *On the Study of Soils*, written while he was the honored head of our National Agricultural Department at Washington, says:

"Unless one has a large supply of cheap manure at hand, it is doubtless sound policy to grow *green crops* with a view to form a rich mould for the production of grain, cotton, hemp, tobacco, or sugar-cane. The farmer should have a full knowledge of the increase or diminution of organic matter in each field every year. If it is cultivated in a hoed crop, and that removed, he may safely assume that the aggregate of mould has been diminished through the agency of tillage. Where a crop of small grain has been grown, and the ground seeded, either by art or nature, to a degree which gives a good return in grass, clover, or weeds, and the vegetation be allowed to rot on the field, the loss of organic matter effected by tillage and cropping may be fully compensated."—(Agricultural Report of 1850, page 29.)

Again, he says:

"Instead of impoverishing the earth, a sound public policy demands that we should *increase* its natural fruitfulness to meet the increasing wants of an ever-augmenting population. To achieve this result in the most economical manner, recourse must be had to the agency of growing vegetation. Among the plans best adapted to the improvement of land are the grasses, trifolia, clovers, legumes, turnips, and other root crops. In skilful hands these can be so managed as to produce a great deal of cheap manure to enrich the surface of the earth, while the substance of the manure itself will be mainly drawn from the subsoil and the atmosphere. Peas have proved the best crop in the southern States for the renovation of partially exhausted fields."—(Idem, page 65.)

And he closes his essay as follows:

"So soon as one crop is off the ground, another should succeed, not indeed further to exhaust the soil, but to collect, in growing plants, all the available elements of human food and clothing within their reach to be carefully husbanded for future use. If the renovating crops be turned in by the plough the soil gains carbon and nitrogen from the atmosphere; if consumed by domestic animals the farmer has their manure, which costs him next to nothing. One who knows how to use growing plants to the best advantage can improve his land at the least expense. Indian corn possesses many elements of productiveness, and in skilful hands will add rapidly to the organic and inorganic food of other crops where all such food is preserved from waste. Turnips are extensively used for a similar purpose in Great Britain, and may be equally so in this country."—(Agricultural Report of 1850, page 81.

Now, here is authority upon authority from the best agricultural writers of Germany, France, England, and America. And does it not present a chain of evidence at once so harmonious, clear, strong, and conclusive that we can have no room for doubting the advantages of, and even absolute necessity for, green manuring if we wish to increase and preserve the fertility of our land? As H. S. Johnson, of New York, says:

"Farming, wisely conducted, is a continued succession of exhaustion and replenishing. The best method of replenishing the land should, in all rotations, be regarded as the leading object. The crop which brings the most money is not always the best. Not a few look only to immediate profit, and their management of the soil perfectly harmonizes with this one idea. Future fertility is disregarded; everything possible is taken from the field, and nothing returned to it—nothing done to restore its wasted energies—nothing to check the progress of exhaustion. If the farm, when new, was rich and fertile, it soon becomes barren and sterile, and the misguided occupant is ready to abandon the desolation which his improvidence has spread around him, and seek more fertile lands in a new country."—Agricultural Report, 1850, page 126.

11. Increase of Green Manuring in our country.

If the data furnished us by our United States census reports are correct, as I presume they are, then we have the gratifying fact revealed to us that green manuring, for the support and improvement of our soils, is greatly on the increase in our country.

Our red clover-seed crop amounted, for the whole United States, to the following number of bushels of seed in 1849 and 1859, to wit:

1849	468,978 bushels.
1859	929,010 bushels.

Thus showing an increase of 460,032 bushels of this valuable seed within ten years, or from 1849 to 1859, being an increase of nearly 100 per cent. And the red clover-seed crop of our loyal States alone amounted, at the same time, as follows, to wit:

1849	432,742 bushels.
1859	881,918 bushels.

Thus showing an increase of 449,176 bushels of its seed in these States within ten years, being an increase of 103 per cent. The increase of our other grass-seed in our loyal States, during the same time, was even greater still. Grass-seed crops then stood, in bushels, as follows, to wit:

1849	280,037 bushels.
1859	791,698 bushels.

Thus showing an increase of 511,661 bushels of grass-seeds, strictly so called, in these States in the ten years extending from 1849 to 1859, being an increase of 182 per cent. The growth of this clover and grass-seed shows us that all the roots of their growing plants and a considerable portion of their plants themselves must have been used in some form or other for manurial purposes. In commenting upon the facts, Mr. Newton, the present Commissioner of Agriculture, has very correctly said:

"This would present a healthy condition of agricultural production if the clover fields when ploughed up had full crops on them; if their after-math of the meadows had not been pastured, and the pasture grounds not been eaten down during the year prior to their being ploughed up. But too seldom are these crops left on the field. Hence our soils are not sufficiently restored from the exhaustion caused by cereal, tobacco, and other crops."

He thus mildly but evidently expresses his fears that we *have not*, as a nation, yet commenced anywhere the great work of renovating our soils through green manurial crops, as we might do and ought to do, and must do, if we wish to maintain our standing as the granary of the world. Still he closes his remarks upon this subject as follows, viz:

"But our correspondence gives hopeful encouragement that there is a *better* cultivation coming. Farmers appear to be awakened, even in the rich lands of the west, to the necessity of improvement, for these lands are seen *to be not inexhaustible*. To keep the vegetable matter of the soil is a duty that begins to weigh on the minds of reflecting agriculturists, and that farming which secures large crops *at the expense of the soil is being condemned as a present profit based on the impoverishment of the generation that is to follow.*

"A correspondent from Michigan, quoting our remark that no greater misfortune could befall our country than the impoverishment of its soil, says: 'I fully concur in that sentiment. The farmers in this country have felt the full force of its truth in years that are passed. Ten years ago, by continual cropping, our land ran down to such a condition that ten bushels of wheat per acre were considered a large crop, but within the last ten years we have resorted, first to rotation, then clovering and plastering, and the use of every load of manure we can make. At this time in this section of our State, the average is twenty-five bushels of wheat per acre.'" (See Hon. I. Newton's Report on Agriculture for November, 1863, pages 11-13. and Preliminary Report of United States Census for 1860, page 89.)

Red clover is one of those manurial plants whose green stems and leaves draw very much, if not even more, of their nourishment from the air than they do from the ground or soil, and so restore to the soil, when ploughed down, far more fertilizing matter than they derive from it. And what is still more in its favor is the fact that it yields the palm to no plant or grass for alternating advantageously with grain crops in convertible husbandry or scientific rotations of crops. Hence I cannot but concur in the sentiments of Joseph Harris, of New York, when he says:

"Next to the turnip, red clover is the most enriching crop; it is far better suited to our climate than the turnip—in fact, there is no country in the world where red clover flourishes better than throughout a large section of the United States. It is pre-eminently the renovating crop of the country. It is almost impossible to grow too much of it, provided it is consumed on the farm. It makes the best of all hay for sheep, and, as we have before said, the manure from it is nearly as valuable as that from corn—far more valuable than that from ordinary hay."—(Agricultural Report, 1862, page 325.)

I cannot but rejoice at the fact that the growth of red clover is greatly on the increase throughout our land, and that the cultivation of the various grasses is also commanding large attention. Still it seems to me that we err very greatly in sowing and growing this clover and our various grasses singly or by themselves alone—as, for example: 1st. Red clover alone, and timothy alone, or by itself; for many of our clover fields that are now but thinly covered with red clover would have far denser, and heavier, and better masses of vegetation on them than they have, if some other valuable plant and grass seeds had been mixed and sown with our red clover-seed. Allen in discoursing on this subject says:

"Such are the various demands of plants and the necessity of providing each with its specific food. And hence the advantage of cultivating a *variety* of grasses and clovers on *the same spot*. Each, it is true, draws its nutriment from the same elements, but in such

unlike proportions that when they cease to yield adequate support to one, the soil may still be rich in those which give luxuriant growth to others. Thus *two* or *more* of the forage plants, when growing together, may each yield a large crop, swelling the aggregate product far beyond what would be realized in the separate cultivation of either. This is a conspicuous and satisfactory illustration of the utility of good husbandry as shown in the cultivation of the mixed grasses and forage."—(Allen's American Farm Book, page 118.)

I am strongly inclined to think that if the various grasses suited to our different soils were *mixed together* in suitable proportions in sowing, and so sown as to put some *ten* or *more* different sorts of our best grasses upon the same field, it would yield us far more and better pasturage and hay, and also serve to keep our soils in a richer and better condition, than the sowing of merely one or two grasses, however good in themselves considered, usually does or can do. The same remark applies with equal or even stronger force to plants and grasses grown for manurial purposes.

12. Objections to Green Manuring.

Various objections have been made to green manuring—such, for example, as that it is too laborious to attend to; that its seeds are too expensive and often fail to grow when carefully sown; and that red clover, even when nicely grown and ploughed down, sours the land and injures or destroys the wheat crop grown on it. Green clover ploughed down as a manure does, indeed, at times sour the land and injure the growing wheat crop sown thereon.

Dr. Joseph Henderson, of Mifflin county, Pennsylvania, in speaking of this subject, says:

"Experience here is adverse to turning down green crops as fertilizers, and few, I believe, have repeated the experiment. In two instances in my own immediate neighborhood, wherein heavy crops of clover were ploughed in in full bloom, upon land of excellent quality, the immediate effect, at least, was highly pernicious, as evinced in an almost total failure of the succeeding crop of wheat. I am disposed to attribute this result to the mucilaginous and saccharine matter with which the plant in this State so much abounds, and which, by being buried in the ground and subjected to the united influence of heat and moisture, takes on the acetous fermentation and thus becomes (vinegar) so detrimental to healthy vegetation.

"I do not say that such consequences *always* follow the ploughing down of green crops, for here experience would seem to be against me, and many circumstances, such as the state of the ground, temperature, rain, or drought, might conspire to bring about or prevent such a result. Be this as it may, however, there can be nothing gained by the practice, as clover loses none of its fertilizing ingredients by drying, and hence we find that a heavy mat of dead clover which has been trodden by our cattle the previous season is as good as a coat of manure, and for this reason the farmer whose staples are wheat and corn should not overstock his farm through the summer. A good rule is to keep no more (animals) than can be conveniently wintered."—(Agricultural Report, 1850, page 247.)

Macro, an eminent British farmer, says:

"From upwards of twenty years' experience I am of opinion that the best way of sowing clover lands with wheat is to *plough the land ten or fourteen days before you sow it*, that the land may have time to get dry, and after rain to make it dress well. I am at a loss for the wheat thriving *better* on lands which have been ploughed some time than it does on *fresh* ploughed lands, which dress as well or better; but I have often tried both ways on the same lands, and always found the former answer best."—(Fessenden's Complete Farmer, page 115.)

Now the formation of acetic acid, or vinegar, in the decaying or fermenting red clover so ploughed down as a manure, explains in the effects the whole mystery that Mr. Macro could not see into or understand. His experience shows us that all we have to do to avoid these evil effects upon our wheat grown on a green clover lay is not to sow our wheat on such ploughed fields until some ten or fourteen days or more after the clover is ploughed down, as the forming acetic acid will in that time either pass away or lose its injurious influence. But, if you are afraid of souring your land and spoiling your succeeding wheat crop by the ploughing down of your red clover in its *green* state, you can easily avoid

these evils by letting your clover crop get ripe and dry before you plough it down, as recommended and practiced by Dr. Henderson and other farmers of Pennsylvania.

Joshua S. Keller, of Schuylkill county, Pennsylvania, says:

"Clover, after growing up a few years, ought to be turned under when fully ripe, with a good plough. Let those who advocate the green state do so to their hearts' content. I have the experience of both the dead-ripe and the young green, and would by no means suffer the latter if I could prevent it."—(Agricultural Report, 1853, page 87.)

Some farmers, holding views like those of Mr. Keller, prefer leaving their green manurial crop of red clover and the like stand and ripen and become quite dry in its stalks and leaves before ploughing it down. But such dry vegetable matter not only decomposes or decays more slowly, and so makes a less rapidly active manure than if it had been ploughed down in a green state, but also contains less fertilizing power, as part of this vegetable mass in the process of drying evolves carbonic acid gas, which passes away into the air and is so far lost, while more or less of its entire saline and mineral elements is also lost by exposure to the open air and the soaking of heavy rains; hence it is very clear that such vegetable masses have, when ploughed down in a green state, not only more fertilizing matter, but also make a *more rapidly active* manure than the same masses have or can have when ploughed down in a dry or dried state. The greater slowness in the decaying of such dry vegetable matter has, indeed, given rise to the idea entertained by some that *dry vegetable* manure is better or stronger than such green manures, but this idea is manifestly erroneous according to philosophical principles. Green manure is also, so far as its own elements alone are concerned, much more valuable than the same amount of vegetable matter is or can be when dried, cut, and fed to live stock or spread out in the barn yard or elsewhere to be converted into manure, as much, very much of its strength is wasted or lost in this way, and this for self-evident reasons. Professor Johnston, in his valuable "Lectures on Agricultural Chemistry and Geology,' has, in speaking of this very subject, very properly said:

"It is, therefore, theoretically true of dry, as it is of *green*, vegetable matter, that it will add most to the soil if it be ploughed in *without* any previous preparation, as by mixing it with animals' dung, as aforesaid; yet this is not the only consideration by which the practical man must be guided. Instead of a slow and prolonged action upon his crop he may require an immediate and more powerful action for a shorter time, and to obtain this he may be justified in fermenting his straw with the certainty even of an unavoidable loss. Hence, the disputed use of short and long dung becomes altogether a question of expediency of practical economy."—(Page 433.)

It follows, however, that such green manuring should, from its greater rapidity of decay and of beneficial action, be repeated every second or third year upon the same ground to fully sustain the strength of the soil. The other objection to green manuring requires no comment, for he who wants to improve his land and keep it productive must not mind the expense and labor that it will put him to to purchase the seeds of good green manurial plants and grasses and sow them upon his ground.

CONNEXION OF NATURAL PHENOMENA OF THE SEASONS WITH AGRICULTURE.

BY JOHN L. RUSSELL, OF SALEM, MASSACHUSETTS.*

EVERYTHING connected with the earth may be comprised under two great heads, namely, inorganic and organic matter. Many of the first can be touched and seen; others cannot, but are none the less real. It is, however, with the second that we have the closest relations, and on their existence our own depends. Between all there is an intimate connexion, and science shows us what that is.

Organic matter has two great divisions, namely, animals and plants. The first seems to be the highest development in the scale of being, and yet most intimately dependent on the second and lowest. Animals could not live without plants, and plants could not live, act, or grow without the agents which belong to the inorganic kingdom. Organic life, in plant and animal alike, is maintained and influenced by air, moisture, light, and heat principally, and by other material substances beside.

The process of vegetation or plant-life is an ever-present phenomenon. Nowhere on the earth, if there are air, moisture, light, and heat in proper proportions, is there a spot destitute of some sort of plant-life. The instant tendency to vegetation may be perceived in a very simple experiment of exposing pure distilled water in an open but perfectly clean vessel to the sunshine; in a few days vegetable life may be seen in it. Its first appearance is in the form of minute green specks, from which bubbles of gas are evolved. These green specks are veritable organized plants, as the miscroscope will determine. The green color which these specks bear is due to the action of the sun's rays, the same action which brought them into being, and which, by decomposing the carbonic acid gas which there is in the air, produces by the process a waxy secretion called chlorophyl. This word means literally "color of the leaf," and it is a substance which in all leaves gives them their verdant lustre. Each of these specks is the lowest possible form of the leaf, but at the same time each is a plant, endowed with the principle of life and capable of increasing to an indefinite extent. By and by these specks increase so fast that they form a green scum on the surface of the water, or creep up the sides of the vessel and coat it with a thick covering. They may always retain this condition of simple vegetable life, or may develop into higher forms. Once created, so to speak, multiplication goes on constantly, so long as air, moisture, light, and heat are properly supplied.

Again, the surfaces of beds of solid rocks, when laid bare by removal of the overlying drift and gravel, are found to be smooth and almost polished. These surfaces are now left exposed to the four combined agencies previously mentioned. If the moisture be in the form of melting snow, of rain, or of water trickling from springs, vegetation covers the rocks the more rapidly, and assumes not only the form of a green scum or slime, but also of various and distinctly colored substances, which, when dry, seem like permanent stains, or like patches

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of paint. The microscope again reveals the nature of these substances, and shows vegetable life in a higher form than in our first instance. Some of these stains are even of the most brilliant dyes, owing to the chlorophyl within them being converted into brighter coloring by vegetable chemistry, just as the ripening of fruit is accompanied by the beautiful tints which we see in it. Such is the protococcus or red snow of the Arctic regions, and such the bloody stain (hæmatococcus) of the more temperate zones, both distinct species of plants so low in the order of existence that their presence is only perceptible by innumerable individuals massed together like patches or stains.

Still higher in the scale, but of similar exterior, are those green, gray, roseate, brown, black scurfs on palings, brick walls, stones, bark of trees, and the like substances, noticeable equally on plains, mountains, by the sea-side, in forests everywhere, if air, moisture, light, and heat be propitiously present. It is the office of the botanist to accurately distinguish between these forms of vegetation, to analyze their structure, to define and illustrate their functions, and to account for their origin, distribution and use. It belongs to the chemist to explain the processes by which they decompose the air which surrounds them, and how they act upon the rocks, the water, the living bark, the dead wood, or the hard earth on which they severally grow, eliminating therefrom the nutriment essential to them, and converting these substances into soil for other plants. It is the province of natural philosophy to teach the process by which the earth's surface is warmed by the sun, and how its light causes the germination or sprouting of the seed, and the growth of the new-born plant. With what information we obtain from these and such kindred teachers, we can calculate with some degree of certainty upon the evidences of the phenomena of nature as our instructors and guides in our avocations and pursuits. Let us apply such facts to agriculture, a business which lies at the very foundation of social industry and art.

Man, though at the head of organized being, and though endowed with reason, yet is as progressive, when viewed through the race, as either plant or brute. In his lowest condition he is the wild savage, content with the vermin and roots he digs from the earth with his fingers, or with the very rudest tool; or, rising, he appropriates the spoils of the chase for food, clothes himself with skins, fabricates weapons, and builds huts; but only as he advances upward does he think of cultivating the soil for the sake of what his labor upon it can bring him. His first efforts in agriculture at once exalt him, and he leaves his nomadic habits in part for a settled habitation and a home. Once established, his observation expands, and he endeavors to propitiate the favor of the seasons in his notice of the natural phenomena by which he is visited. The coming forth of the animals from their winter's sleep, the return of the birds, the blossoming of the early flowers, the leafing of the forests, all remind him that warmer sunshine and blander winds will work for his sake. Such data which have been noticed ages ago have been held in more or less veneration ever since. They can be proved to be reliable only by the closest and most constant observation. Such unremitting attention to the most minute particulars enables science to evolve from them principles of universal application, and help in some way, perhaps, to render the manual labor more facile by the faculties of the mind. And thus, in every part of agriculture, nature yields pliant facility to experiment, and to care and pains almost every desire of the human heart seems likely to be given freely and without stint.

It is affirmed that these notions, which are said to be current among the wild tribes of our own continent, and to which I have alluded as indications of the progress from the lowest condition of human life to a higher and better, can be made, in some degree, our guides in the labors of the garden and the farm. The object of this essay is to ascertain, if possible, what reliable connexion the phenomena of the seasons have with agricultural operations. I approach the subject with some hesitation, because it seems problematical whether we can

derive much knowledge of a positive character from the proverbial wisdom of the rudest forms of an occupation which demands for its fullest success the highest powers of the intellect.

The seasons of the year depend upon astronomical conditions unvarying, and the same ever since the memory of man. The revolution of the earth, by which it is presented to the sun, brings to it regular visits of light and heat. Without light and heat, which some consider to be identical, there cannot be any organized life. The higher the sun, seemingly, rises in the heavens, the more warmth it imparts and the more intense and continuous is the light. Every zone of the earth has its day and night, its winter and summer. In all, the commencement of the latter is its spring—vegetation starts with renewed energy; while the former brings repose and rest. Few plants are so hardy as to grow in the winter time, where cold prevails at that season, and only where the rains are abundant on approach of winter does vegetation awaken to its energies. Even the arctic circle has its time of vigorous and active life, its summer and spring days; and the perpetual growth of equatorial regions depends on astronomical laws. The same *sun's* rays bring into gorgeous beauty the minute alga which *crimsons* the icebergs and cliffs of the far north, and which spreads the immense foliage of the loftiest palms of tropical deserts. Only in such temperate regions as our own can we see the gradual and delightful march of the seasons from sternest winter, and its almost desolation, to the first opening bud of flowery spring. After the sere and yellow leaf has fallen, and the forests and the golden fringes of the witchhazel have withered beneath November's frost, a host of hardy mosses still survive to grow, and at every rain or gleam of sunshine expand their delicate foliage and push up their tender and exquisitely beautiful fruit-urns. But these, too, yield at last to the tyrant winter, and stand, like sentinels at their posts, alive and vigilant, to be summoned to duty and activity at the first call of spring. Then, while the globe is retracing its path through ether, and the sun appears to rise higher and higher above us, they, like all other hybernating organizations, feel within their tissues the vernal warmth, and vie with nobler forms of vegetation to grow, mature, and be renewed.

If we ascend the higher mountain peaks to see what forms of vegetation greet us there, we shall notice how distinct and defined are the belts or zones of plant life. Above all, we come to the humblest and least conspicuous in those crustaceous lichens, whose slow accretion is measured by centuries. But higher than these, even where there is no perpetual snow to cover the rocks, nothing but frightful sterility reigns. Such absolute barrenness lies far above the regions of clouds, and however direct the sun, however vivid the light, yet moisture is wanting. The exploring expedition of the United States found, however, near the crater of Mauna Loa, amidst a perpetual and perfect desert of bare rocks of six miles extent at least, a tiny moss, which grew in a crevice from which issued vapor, which, with the subterranean heat, sustained and nourished it. In this mere crack it found the elements necessary to existence—heat, light, moisture, and a soil propitiated by these essentials.

The presence of heat is, then, all-important. From whence can the earth receive this, and how does this fact apply to agriculture? From two sources, namely, the internal heat of the soil and from the sun's rays. The first must be expected only in volcanic regions, where fertility is always constant and marked. Where heat obtains in this way, cultivation can be carried on at high elevations with success, where the sun's rays alone would be inadequate. From this hint, this natural phenomenon, we construct apparatus to supply subterranean heat: such, in fact, being the hot-bed, where fermentation or steam pipes give us the required temperature. But where we must depend on the sun's warmth, we wait the spring, and try to ascertain at what precise time the earth becomes warmed up by its rays. Yet, notwith-

standing we may have artificial heat, and the sunshine too, we find in our greenhouses, and in other plant structures, that something is wanting to perfect cultivation. Science has analyzed the sun's light to discover where the defect exists. It has found that light itself, which seems to us white, is really composed of seven colors. It has proved that each of these colors possesses different chemical powers and action; that some are better fitted for the sprouting of the seed, and others for the greening of the leaves, and others still for the ripening and coloring of the fruit. More, that at different seasons of the year these several colors predominate in the sun's rays.

A reliable and most careful cultivator of the grape in glass forcing-houses assures me that his vines start with a surprisingly renewed activity after the first of January—their foliage is ampler, richer, and greener. Were plants like animals we could not so readily understand this curious circumstance. Were they endowed with a nervous system they could, at all seasons, be stimulated through nutritious manures, which are their appropriate food. We can fatten the animal at any time of the year as well, or perhaps better even, in some cases at least, in the dark as in the light. But plants have no nerves and no internal, distinct alimentary cavities or digestive apparatus. Their instruments of digestion, assimilation, and increase are on their surfaces, or near the exterior of their leaves and bark. Their leaves usually, to be sure, are delicate and sensitive, but the process or action of life in them is mechanical; the sun's rays give them motion in the flow of sap and its consequences. It is a chemical action; decomposition of whatever they are surrounded by is brought about on their exterior; on the contrary, animal life is preserved by decomposition of substances received within. When the yellow ray is abundant, then plants take on the green color, so pleasing and grateful; the yellow, the blue, and the red rays help the germination of the seed; but the best of all is the violet ray. The curious gardener seizes upon this hint and employs the violet-tinted bell-glass when he wishes to germinate some choicer seeds. The red ray of autumn ripens the fruit; it is this that gives color to the leaves of the forests and imparts to the autumnal scenery its peculiar splendor. The more abundant these are in a climate's atmosphere, the more luxuriant and gorgeous will be its vegetable aspects; the scantier their presence, the tamer and more deficient the beauty around.

It appears to me that we yet need some more exact ideas than can be gleaned from the signs derived from the natural phenomena of the seasons as they have been noted. These ideas must be found in the actual condition of the earth in regard to the amount of heat, principally, that will insure the germination of seeds committed to the soil. It may be asked, whether every latitude has a defined and specific season of the year, when, as it returns, it shall be the very one for this or for that kind of labor? Can the reappearance of the migratory birds teach us anything? Can the opening of the vernal blossoms, or the exact time they shed their pollen or ripen their seeds, can the unfolding of the tender leaves or their maturation and fall, give us any valuable hints? Of these, which can show us what the thermometer will surely do if we plunge it into the soil daily and examine how the mercury rises or declines? Or can the barometer be any guide by which it is probable that storms, rains, or winds, injurious to vegetation, will repeat themselves at stated periods from year to year? What can we learn from the breaking up of rivers freeing themselves from ice? What from the temperature of flowing water, of the daily tides, or of springs and wells?

That was a pleasant fancy of Linnæus which supposed that the different hours of the daytime could be denoted and ascertained by the opening and closing of certain flowers—making thus a floral clock. So the pimpernel *(Anagallis arvensis)* foretells the humidity in the air. Can the farmer's times for ploughing, sowing, and reaping be so pointed out? Is there anything in

that widely diffused notion said to have obtained as a rule among the Indian tribes, that when the oak and hickory leaves are of the size of a squirrel's ear Indian corn must be planted? Or that other, that a colder winter is to come after the husks over its cobs are thicker than usual? Or may there not be some other and more rational way of accounting for the habits of animals which have been taken for "signs" than that commonly employed?

In order to approach this part of our subject understandingly we must examine the process of germination. With regard to the internal structure, all seeds are similarly fashioned, though they may be very diverse on their exterior. Every variation of size is possible, from the fine, dust-like seeds of numerous plants to those large and bulky forms of the cocoa-nut palms. Yet, in all alike, the essential portions of the seed are the cotyledon or seed-lobe, the radicle or young root, and the plumule or young sprout. The cotyledon, whether there is only one or are many to each seed, is a cellular body, containing either albumen or starch, and susceptible of imbibing water from the soil. A small aperture, called the "hilum," admits moisture to the interior of the seed and allows the escape of the young plant. On the reception of moisture of the right temperature a healthy chemical action takes place, the tissue of the cotyledon swells, the starch or the albumen is converted into nutriment, the young leaves receive this, the young root pushes downward, while the young plant pushes upwards and is launched into aerial life. This process, identical in all germination, yet is dependent on atmospherical conditions, and perfect success is insured when darkness, moisture, and heat are in proper proportions. The first is secured by covering the seed in the earth at the exact depth its needs require; the second by rains or artificial irrigation; and the last by repeated observation. Should the last be wanting, the other two are valueless; a chemical change likewise, however, occurs, but it is that of putrefaction, and the vitality of the seed is lost. What that precise degree of heat or warmth is, which each sort of seeds requires, is known only by nice and accurate experiment; the usual way is by guesswork or by some equally unreliable method. Some gardeners and farmers are influenced by empirical rules, such as the phases of the moon, by some day of the month or of the week. Others, of more reflection and observation, have still thought that the flowering of plants, the blossoming of fruit trees, or the like, would be safer guides, better to be trusted than the almanac or the face of the sky or earth. I am not aware of the existence of any extensive tables of observation respecting the degree of heat requisite to the best and surest germination, yet, from scattered data, I shall be able to make some statements which may be worth notice, and which will presently follow.

It is not an infrequent occurrence that failure in part follows too early planting, and this is a source of vexation and expense. If the farmer's seed-corn rots in the ground something unpropitious is the cause; is it the cold rains of the latter part of May, or the uncongenial character of the earth in regard to the due amount of warmth? In market gardening, if the squashes be cut off by late frosts, does it not teach a profitable but sad lesson that haste makes waste? A check to his sweet potato sprouts may seriously affect his whole crop, and render it comparatively light. I notice in an agricultural paper, published at Lawrence, Kansas, that this root may safely be deferred in its planting even till the 10th of June, and yet obtain a fair crop. What is gained by hastening the planting of the Saba or Lima beans which need the warm soil to germinate and then to push them ahead?

In temperate regions, like that of New England for instance, one is hardly aware of the power of solar heat in raising the temperature of the ground. As soon as the deep snows have melted, and the surface of the earth is there exposed to the sun and to the winds, the frost rapidly disappears, and the thaws penetrate deeper and deeper every day. Of course, much will depend on the

nature of the soil; if light and sandy, it is the sooner warmed and dried. A black peaty soil, though absorbing the sun's rays, does not thaw so thoroughly at so early a period as a lighter and sandy one. Lastly come in order the stiff, clayey soils; so that the sandy soils of many parts of the United States are not devoid of value and interest to the cultivator, because, with proper and stimulating manures, the increased warmth they possess forwards the crops through the entire season. We can see this on a small scale under the lee of a close-boarded fence, or on the southern side of a stone wall, where lettuces, cress, and radishes can be sown, near Boston, as early as the last of March. A few days of sunny weather are sufficient for the seeds to germinate, and the plants will thrive and grow very well, although April snows may repeatedly cover them an inch or two deep. A plant of the cruciferous tribe, of diminutive size, known as whitlow grass, (*Draba verna*,) frequently blossoms as early or even earlier than this, which I find growing at Danvers, Massachusetts, out of the wet turf and among mosses bathed in the cold water of melting snows. The cabbage is sown by market gardeners in this vicinity in what are called cold frames, where the pulverized soil properly manured is warmed only by the sun's heat, and this heat acquired by day is partially maintained through the night by covering of straw mats. The plants transplanted into the open ground on the 15th of April furnish a valuable return by the 9th to the 20th of June. The pea is even sown in February, if the soil admits being dug and raked, but in this latitude little is gained in such experiments; even though germinating, the foliage on its appearance above ground is feeble, yellow, and sickly; the plant waits for auspicious showers and winds. I have seen the early meadow grass, (*Poa annua*,) which ordinarily blooms in April and ripens its seeds in June, expand its flowers early in March in some warm and sheltered spots; yet its blooming at this season could be considered no criterion that the coming spring was to be an earlier one than usual, or that the earth would be sooner fitted for ploughing or for sowing. To look for the appearance of flowers, for the leafing out of trees, for the cries of the frogs, and the like periodical phenomena, in order to facilitate agricultural operations, we must connect with them other data, by all which combined we can estimate how warm is the ground to which we wish to commit our seed, and from which we anticipate a speedy return in the form of desired crops.

To form some sort of judgment of what is required by vegetation, let us take asparagus. According to some records by James Winthrop, esq., Fellow of the American Academy of Arts and Sciences, &c., asparagus was fit for the table at Cambridge, Massachusetts, in the year 1793, on the fifteenth of April; in the year 1794, on the twentieth of April; in the year 1795, on the twenty-sixth of April; and in the year 1796, on the twenty-fourth of April. In the year 1803 asparagus was offered in Boston market on the twenty-seventh of April, and in the year 1804 on the nineteenth of April. (See papers published by the Massachusetts Society for Promoting Agriculture.) In the year 1813, according to the Hon. John Lowell, of Roxbury, Massachusetts, asparagus fit for table use came on the fourteenth of May; in the year 1815, on sixth of May; in the year 1816, on fifth of May; in the year 1818, on fifteenth of May; in the year 1820, on the first of May; and on the same day of May in the year 1822. The town of Roxbury, the residence of Mr. Lowell, is about four miles southwest of Boston. According to the best authorities in gardening, to force asparagus in order to have it in use at an unusual time of the year, the soil of the forcing frames must never be lower than 50° Fahr. at night, and by day the maximum heat may be 62° Fahr. The minimum of required warmth in the soil is at least twenty-five degrees less than is usually employed in the ordinary hot-bed used for germination and growth of some kinds of plants. Let it be understood that these fifty degrees of heat must be uniformly maintained in order to push forward the stalk and force it into growth above the ground. Was there, then

all that difference between those springs when asparagus was a month earlier—between 1793 and 1818; or between 1804 and 1813—a difference of actual heat of the ground out of doors; and, if so, to what causes can it be traced? What has the winter previous to do with it, and does diminished heat of that season affect the power of heating by the sun the months of March, April, and May? It is a commonly received opinion that cold summers follow severe and cold winters, and in some instances such is the case. Thus, the summers of 1836 and 1837 were so cold that "Indian corn did not ripen in Massachusetts, and the winter of 1835–'36 was said to have been the coldest since that of 1780. Long Island sound was closed about six weeks, and in the county of Berkshire, Mass., large numbers of our native forest trees were destroyed."—(R. T. Paine, in the *Boston Evening Traveller* for March 28, 1850.) If I rightly comprehend this subject, however, I do not think that it is the amount of cold or its intensity that injuriously affects the coming spring or summer, but the condition in which the winter's snows find the earth. If the ground is slightly frozen, or, which is possible, is free from frost when it is covered by the first snows, and the cold prevents these snows from melting away before other and successive snow-storms succeed, the soil, on the return of spring, will rapidly absorb all the melting ice and snow, and an early spring may be the result. In this case the earth will be ready to become warm much sooner than when a hard and frozen soil receives scanty snows throughout the winter. Something of this sort we find in the Arctic regions, where the warm and cellular snows at the end of summer bury the earth in a light porous envelope, which, by and by, is protected by the denser and drifting snows of the winter-time. The present winter, 1864–'65 is one of unusual continued cold: does it follow that our coming summer will be unpropitious? Conjecture can be, I fear, of little value, and time can only tell. Still, if there is anything to be gained by such "signs," and no expectation of certain crops can be predicated, it were well worth the knowing beforehand that we labor not in vain.

There is another point to be considered, viz: whether in sections of country unvisited by deep snows and severe freezings, and where the bare ground is exposed to the sun's rays earlier in the year, the springs are always proportionally more forward, or this precocity, if it exists, can be depended on? In other words, will a more southern latitude of two or three degrees help the soil, so that it may be sooner fit for cultivation in consequence of its facility of being sooner warmed?

From notes on vegetation, made at the United States Naval Observatory at Washington, D. C., latitude 38° 53′ N., during the year 1864, kindly furnished me by the late Captain J. N. Gillis, through James S. Grinnell, esq., I find that asparagus is fit for the table on the 28th of April, which, as it will be perceived, is not so early as at Cambridge, Massachusetts, in the years 1793–'95 nor as in Boston in the years 1803–'4, and about a fortnight sooner than in Roxbury, Massachusetts, in the years 1813–1822. The winter of 1863–'64 was mild, with much rain, and cold weather did not visit us until February, and then for a few days only. The middle of March had a few cold days; but the average of the winter was that of open and mild weather. Taking for granted what I have unfortunately no means of proving, that the asparagus season or the time for cutting it is the average one at Washington, as denoted in 1864, then the occasional precocity of more northern and eastern climates, like that of Boston and Cambridge, must be due to some extraordinary causes, which must be taken into account in the general scope of our subject.

Should one still further estimate the degree of warmth, and even heat, to which the ground is raised by the sunshine, we should find it far greater than is ordinarily suspected. The range favorable to vegetation is from 34° Fahrenheit to 140°, as already intimated; in like manner, too, the very germination or first vital action of the seed must have between 34° and 40°, so that there be no

danger of decomposition, and sufficient warmth to maintain circulation. The common pea, to which I have alluded as being sometimes early sown, requires at least 40°, and when it is forced for early use the temperature is from 45° to 52°; that of the air to keep it growing healthily is at 66°, and after it has flowered from 52° to 70° is necessary to mature its pods. An ordinary green-house, which contains a miscellaneous collection of hardy plants and shrubs flowering in the winter months, may be regulated to advantage, if its temperature be not lower than 40°, but by the sun's rays in the day-time it may rise to 60°, or even higher, to fall again to 40°, or a little below. The cooler temperature of the night-time is favorable to all plants, inviting them to repose, by diminishing their excitability.

Professor James F. W. Johnston, in his lectures on the general relations of science to practical agriculture, delivered before the New York State Agricultural Society, in 1849, states that in this country the temperature of the earth five feet below the surface may be warmed by the sun to 100°, and at half an inch below the surface sometimes rises as high as 140° Fahrenheit. Such statements seem scarcely credible; yet, according to Dr. Coulter, there grow plants on the banks of the Rio Colorado which occasionally endure this heat. Sir John Herschel found the soil in his bulb garden at Cape Good Hope, on the 5th of December, 1837, between 1 and 2 o'clock p. m., raised to 159° of heat, and at 3 o'clock p. m. it was 150°, and even in shaded places 119°. The temperature of the atmosphere in the shade in the same garden at the same period was 98° and 92° Fahrenheit. At 5 o'clock p. m. the soil of the garden, having been long shaded, was found to have, at four inches in depth, a temperature of 102°. On the 3d of December, a thermometer buried quarter of an inch deep, in contact with a seedling fir of the year's planting, quite healthy, and having its seed leaves, marked as follows: at twenty-five minutes past 11 o'clock a. m., 148.2°; at forty-eight minutes past 12 p. m., 149.5°; at thirty-four minutes past 1 p. m., 149.8°; at fifty-four minutes past 1 p. m, 150.8°; and at forty-six minutes past 2 o'clock p. m., 148° Fahrenheit.—(*Lindley's Theory of Horticulture,*) Similar statements were made by Professor William Henry Harvey, in his lectures on botany before the Lowell Institute at Boston, Massachusetts, in 1849, when he also stated that desiccation of the soil in consequence was so great that severe labor was requisite to lift the bulbs of the amaryllis, gladiolus, and kindred genera from the earth, and that each year's successive decay of leaves formed an envelope around the bulbs which served as protection, and preserved their vegetative powers. From accidental circumstances it has been proved that a similar drying process will not injure the gladiolus in cultivation, but rather seems to serve as a stimulus to activity on application of moisture. Gardeners have long resorted to similar expedients to induce certain succulent plants to flower, by delaying their seasons of repose and rest by heat and dryness. Such well-observed facts confirmed the previous statements of Bruce, that the temperature in the sun at Gondar has been as high as 113°; at Benares, 110°, 113°, 118° according to Harvey, and at Sierra Leone, 138°, according to Winterbottom.—(*Edinburgh Philosophical Journal*, No. 27.) From such data we are again confirmed in our previous statements, that to estimate the relations of the seasons to vegetable life, we must discover the degree of warmth in the soil suited to every plant, from its stages of germination to those of ripening and decay.

Let me now advert to another possible source of information gathered from the law of isothermal lines of climate. By this beautiful theory, first proclaimed by Humboldt and published to the world in the *Memoires de la Societé d'Arcueil* we are able to understand the singular fact that we can place no dependence upon mere latitude in agriculture. Thus, speaking in a general way, we find the temperatures of climates diminish as we pass from the equator towards either pole. Put to the rigid test, however, we do not find that there is the same

degree of heat in all parts of the same parallel, and that the variation is sometimes remarkable. By keeping a record of the range of the thermometer in the same place for a number of consecutive years, the mean or average temperature of that place can be estimated. Such records become valuable and suggestive, and through their use the theory of isothermal lines originated. That which at first was theoretical has since become exact and convincing; and thus a method of representing to the eye, upon a map of the globe, the belts that possess the same amount of heat and of cold, either at certain seasons or throughout the entire year, has been established. Applied to agriculture, we can understand why some kinds of plants will grow better in a more northern latitude than in a more southern, which otherwise would seem anomalous. Let us take, for example, the climate of Norfolk, in England, which is about 52° north latitude; from notes of the advance of spring there, the gooseberry bushes leaf out near the 1st of March, while in Boston, Massachusetts, they leaf on the 20th of April; and they blossomed there on the 13th of April, while in Boston they blossomed on the 5th of May; there the apple tree blossomed on the 25th of April, here on the 20th of May; the red currant bush flowered there on the 3d of April, here on the 9th of May; the apricot blossomed there on the 1st of April, here on the 1st of May; the cherry tree blossomed there 18th April, and here the 6th of May; the peach tree flowered there on the 6th of April, and here on the 8th of May; or the climate of Norfolk, England, from thirty-eight to eighteen days earlier at first.—(*Massachusetts Agricultural Repository.*) So, in the time of planting the ground, we gather from Loudon and other authorities that all the different sorts of peas are sown in England from the middle of February, and by successive sowings to May; the field bean (*Vicia faba*) in March and April; the beet on the last of March; the radish from the 15th of February to end of March; the carrot from 1st February to 1st of March; and the cabbage in February and March; potatoes are planted there from the middle of March to the middle of April for the main crops, and maize or Indian corn is sown in France from the 15th of April to the middle of May. The most southern portion of Great Britain is eight degrees further north than Boston, and yet the springs are more than a month earlier.

Were the surface of the globe everywhere a flat plain and of uniform contour, there would be a greater uniformity of climate. But so great are its inequalities; there is so much more ocean in this parallel, or such mountain chains in that; the surface intersected by broad rivers or diversified by immense lakes; here so rocky, there so much of a desert, so forest-clad, or else so alluvial and prairie-like, the calorific influences of the sun are very unequal. The air of a section of country contiguous to the sea is modified by the winds which blow over it, or rendered moister by the fogs which are borne inland. Such fogs in the spring save the heat for the soil by preventing radiation; so the heat from the sun, which is reflected from the faces of cliffs, helps to warm sheltered valleys and modify their temperature; so that the very diversities in the natural features of a country influence the conditions of contiguous or similar parallels of latitude. But when the temperature of the entire year is taken into the account, the increased heat of the summer more than balances the discrepancies of the spring, or else the intenser cold of winter affects the average heat. The climate of England may be more genial to the efforts of spring, but what it gains then, it loses in the summer months; whereas we gain immensely by the increased fervor of our austral seasons, ripening the most delicious fruits which fail there. The mean temperature of each month is better suited to our inquiries; that of the year, when we wish to ascertain the possibility of introducing new and untried crops. This latter subject will be resumed; at present, let me endeavor to see to what degree of heat the several months of spring arrive, and how such information may be directed into a useful channel.

I have already referred to a brief record of James Winthrop, esq., kept at Cambridge, Massachusetts, and resume it in order to approximate to the mean heat of each vernal month of those precocious years. This I do by the help of the meteorological tables as kept by Edward Augustus Holyhoke, M. D. A. A. S., from the year 1786 to 1829, inclusive; corrected by revision by Enoch Hale, M. D. A. A. S., and to be found in the Memoirs of the American Academy of Arts and Sciences, vol. 1, new series.

Year.	March—mean.	April—mean.	May—mean.	Three months of spring—mean.	No. of fair days.	Cherry.	Peach.	Plum.	Pear.	Apple.	Asparagus.
	° ′	° ′	° ′	° ′							
1793	39.00	49.25	63.25	50.66	52	Apr. 17	Apr. 20	Apr. 16	....	Apr. 29	Apr. 15
1794	39.50	50.00	59.50	48.83	47	23	23	19	Apr. 29	29	20
1795	36.50	46.75	57.25	47.66	42	May 6	27	7	May 10	May 10	26
1796	34.75	49.00	54.50	46.75	43	Apr. 27	23	20	....	4	24

We gather, then, one fact, which is at least singularly coincident, that the mean temperature of the spring of 1793 was equal to the temperature of the earth required to force asparagus, and that year it was fit for table use on the fifteenth of April, in the open ground!

Let me tabulate in the same way the register of the Boston market, as follows:

Year.	March—mean.	April—mean.	May—mean.	Three months of spring—mean.	No. of fair days.	In April.
	° ′	° ′	° ′	° ′		
1803	37.25	47.25	55.00	46.50	63	Little rain.
1804	34.50	44.25	80.33	46.33	55	.....do.....

	1803.	1804.
Asparagus	April 27	April 19
Cherry flowers	May 1	May 8
Peach flowers	April 28	....
Plum flowers	May 1	May 9
Pear flowers	May 5	....
Apple flowers	May 21	May 20
Gooseberry leaf	....	April 7
Apricot flowers	....	May 4
Red currants flower	....	May 4

I have also tabulated in a form, easy to be examined, a series of valuable notes from observations of the late Hon. John Lowell, a most distinguished agriculturist, adding, as before, the mean temperature derived from such sources as were available to me. The range of years is from 1813 to 1839, mostly unbroken, and the notes were taken at his residence in Roxbury, near to Boston.

Table of the leafing and blossoming of plants, with mean temperatures,

IN THE MONTH OF APRIL.

Year.	Day of month.	Trees or Plants.	Mean of month.	Mean of spring months.
			° ′	° ′
1816..	20	Gooseberry leafing.		
	28.	Red currant leafing.		
	29	Apricot blossoming	48 50	
1821..	21	Apricot blossoming	44 00	
1823..	20	Apricot blossoming	49 25	
1825..	1	Gooseberry leafing.		
	10	Peach blossoming.		
	11	Apricot blossoming.		
	25	Cherry blossoming.		
	30	Pear blossoming	50 12	
1827..	12	Apricot blossoming.		
	16	Peach blossoming.		
	21	Cherry blossoming.		
	26	Plum blossoming	50 38	
1830..	28	Cherry blossoming	48 97	
1831..	23	Cherry blossoming	48 42	
		IN THE MONTH OF MAY.		
1813..	10	Cherry tree blossoms.		
	11	Shad bush (*Mespilus Canadensis*) blossoms.		
	14	Asparagus fit for table.		
	20	Pear trees blossom.		
	23	Apple trees blossom	53 33	45 00
1814..				
1815..	1	Apricot tree blossoms.		
	6	Asparagus fit to cut.		
	10	Cherry tree blossoms.		
	14	Plum tree blossoms; gooseberry bushes leafing; corn and potatoes coming up.		
	16	Shad bush blossoms.		
	20	Pear tree blossoms.		
	25	Apple tree blossoms	54 25	44 05
1816..	1	Garden currant flowers.		
	5	Asparagus fit for use.		
	6	Cherry trees flower.		
	9	Shad bush blossoms.		
	16	Apple trees flower	54 00	45 00
1817..	6	Cherry trees blossom.		
	7	Plum and pear trees blossom.		
	12	Apple trees blossom.		
	19	Lilac (*Syringa vulgaris*) blooms	56 00	45 00
188..	15	Asparagus cut.		
	17	Cherry tree blossoms.		
	18	Shad bush.		
	24	Pear trees.		
	25	Apple trees.		
	27	Lilacs	55 75	44 16
1819..	6	Cherry trees.		
	13	Plum trees.		
	16	Shad bush.		
	17	Pear trees.		
	19	Apple trees.		
	25	Lilacs	54 25	42 16

Table of the leafing and blossoming of plants, &c.—Continued.

Year.	Day of month.	Trees or Plants.	Mean of month.	Mean of spring months,
			° ′	° ′
1820..	1	Asparagus cut.		
	2	Cherry trees blossom.		
	3	Shad bush.		
	9	Pear trees.		
	11	Apple trees.		
	20	Lilacs	56 00	45 05
1821..	9	Cherry trees.		
	10	Shad bush.		
	11	Plum trees.		
	13	Pear trees; apple trees.		
	20	Lilacs	56 25	44 58
1822..	1	Asparagus cut; cherry tree flowers.		
	4	Plum trees; pear trees.		
	9	Apple trees.		
	12	Lilacs	61 25	48 25
1823..	3	Pear trees.		
	7	Cherry trees.		
	19	Apple trees.		
	22	Lilacs	54 25	45 00
1824..	1	Cherry trees.		
	4	Pear and peach trees.		
	11	Apple trees	54 75	46 00
1825..	8	Apple trees	57 57	49 49
1826..				
1827..	12	Apple trees	57 02	48 34
1828..	1	Cherry trees.		
	10	Apple trees	56 73	46 32
1829..	3	Apricot trees.		
	9	Cherry trees.		
	14	Pear trees.		
	15	Apple trees	58 94	45 77
1830..				
1831..	1	Pear trees	56 26	47 68
	6	Apple trees	59 14	49 73
1832..	3	Peach trees	53 14	43 71
1835..	30	Apple trees	55 67	44 02
1836..	23	Apple trees. On the 14th of this month ice formed	56 60	44 02
1837..	31	Apple trees. On the 2d of this month the ground froze.	53 46	43 57
1839..	2	Cherry trees; peach trees.		
	4	Plum trees.		
	6	Pear trees	56 76	44 5[illegible]

I have obtained a more complete record from notes kept by Mr. Asa Lamson, of Salem, Massachusetts, from the year 1832 to 1864, inclusive.

Blossoming of fruit trees, plants, &c.

IN APRIL.

Year.	Day of month.	Trees or plants.	Mean of the month.	Mean of the spring months.
			° ′	° ′
1834..	15	Plum.		
	17	Dwarf iris, (*Iris pumila.*)	45 87	
1839..	24	Dwarf iris.		
	25	Plum	48 42	
1840..	23	Dwarf iris.		
	24	Plum.		
	26	Cherry	46 96	
1842..	23	Plum.		
	26	Dwarf iris.		
	27	Cherry	50 73	
1845..	25	Plum.		
	28	Dwarf iris	45 46	
1846..	20	Plum.		
	22	Dwarf iris.		
	25	Cherry	50 27	
1848..	22	Apple.		
	22	Dwarf iris	46 99	
1849..	30	Dwarf iris	45 39	
1850..	30	Dwarf iris.		
1851..	31	Cherry.		
1853..	20	Plum.		
	20	Dwarf iris.		

IN MAY.

Year.	Day of month.	Trees or plants.	Mean of April.	Mean of May.
			° ′	° ′
1832..	21	Apple.		
	28	Lilac	41 38	53 14
1833..	14	Lilac	40 34	58 42
1834..	3	Cherry.		
	19	Apple; pear.		
	22	Lilac	45 87	53 03
1835..	17	Cherry.		
	29	Lilac	44 04	55 67
1836..	2	Dwarf iris.		
	4	Plum.		
	10	Cherry.		
	23	Lilac	44 02	56 60
1837..	9	Dwarf iris.		
	11	Plum.		
	14	Cherry.		
	31	Lilac	45 03	57 46
1838..	8	Dwarf iris.		
	15	Cherry.		
	31	Lilac	42 33	55 79
1839..	1	Cherry	48 42	56 76
1840..	12	Lilac	50 18	57 62

Blossoming of fruit trees, plants, &c.—Continued.

Year.	Day of month.	Trees or plants.	Mean of April.	Mean of May.
			° ′	° ′
1841..	8	Dwarf iris.		
	9	Plum.		
	15	Cherry.		
	29	Lilac	43 14	54 75
1842..	14	Lilac	46 96	54 77
1843..	8	Dwarf iris.		
	14	Cherry.		
	23	Lilac	46 96	54 77
1844..	11	Lilac	50 73	59 38
1845..	3	Cherry.		
	14	Lilac	45 46	57 39
1846..	13	Lilac	50 27	56 64
1847..	6	Plum.		
	10	Dwarf iris.		
	12	Cherry.		
	28	Lilac	44 27	54 82
1848..	1	Cherry.		
	17	Lilac	46 99	58 82
1849..	10	Cherry.		
	24	Dwarf iris.		
	29	Lilac.	45 39	53 65
1850..	7	Cherry.		
	29	Lilac.		
1851..	3	Dwarf iris.		
	19	Lilac.		
1852..	7	Plum and dwarf iris.		
	9	Cherry.		
	23	Lilac.		
1853..	5	Cherry.		
	17	Lilac.		
1854..	9	Plum.		
	11	Cherry.		
	10	Dwarf iris.		
	20	Lilac.		
1855..	7	Dwarf iris.		
	9	Plum.		
	24	Lilac.		
1856..	3	Dwarf iris.		
	13	Plum.		
	15	Peach.		
	23	Apple.		
	24	Lilac.		
1857..	6	Dwarf iris.		
	11	Plum.		
	11	Peach.		
	25	Lilac.		
1858..	7	Peach.		
	16	Plum.		
	24	Lilac.		
1859..	12	Plum.		
	21	Lilac.		
1860..	3	Cherry.		
	18	Lilac.		
1861..	24.	Apple.		
	24	Lilac.		
1862..	8	Cherry.		
	11	Plum.		
	14	Peach.		
	17	Apple.		
	17	Lilac.		
1863	7	Cherry		

IN JUNE.

Year.	Day of month.	Trees or plants.	Mean of May.	Mean of June.
			° ′	° ′
1832..	22	Yellow locust, (*Robinia pseudacacia.*)		
	28	White rose, (*Rosa alba. L. flore pleno*)	53 14	64 35
1833..	4	Locust tree.		
	15	Damask rose, (*Rosa damascena*)	58 42	62 84
1834..	21	Locust tree.		
	21	White rose	53 03	63 12
1835..	6	Locust tree.		
	19	White rose.		
	24	Damask rose	55 67	65 03
1836..	8	Locust tree.		
	19	White rose	56 60	60 12
1837..	21	White rose.		
	24	Locust tree	53 46	64 02
1838..	13	White rose.		
	15	Locust tree	55 79	69 60
1839..	15	Locust tree.		
	17	White rose	56 76	62 91
1840..	7	Locust tree.		
	5	White rose	57 62	67 36
1841..	14	Locust tree.		
	19	White rose.		
	26	Damask rose	54 75	68 73
1842..	9	White rose.		
	17	Locust tree.		
	21	Sweet brier, (*Rosa rubiginosa*)	54 77	64 94
1843..	22	White rose.		
	23	Locust tree	56 42	66 53
1844..	10	Locust tree.		
	12	White rose	59 38	67 11
1845..	9	Locust tree.		
	12	White rose	57 39	68 61
1846..	9	White rose.		
	11	Locust tree.		
	15	Damask rose	56 64	65 14
1847..	23	Locust tree.		
	23	White rose.		
	26	Sweet brier	57 82	66 53
1848..	13	Locust tree.		
	16	White rose	58 82	65 90
1849..	19	Locust tree.		
	21	Sweet brier	53 65	67 57
1850..	19	Locust tree.		
	23	Sweet brier.		
1851.				
1852..	15	Locust tree.		
1853..	10	Locust tree.		
1854..	10	Locust tree.		
1855..	18	Locust tree.		
1856..	20	Locust tree.		
1857..	20	Locust tree.		
1858..	20	Locust tree.		
1859..	16	Locust tree.		
1860..	16	Locust tree.		
1861..	19	Locust tree.		
1862..	12	Locust tree.		
1863..	12	Locust tree	57 43	62 61
1864..	16	Locust tree.		

NATIVE AND GARDEN FLOWERS.

Floral calendar of spring of 1837, kept at Hingham, Plymouth county, Massachusetts, latitude 42° 14′ north.

1837.
May 1. Anemone nemorosa.
Acer rubrum.
Ulmus Americana.
2. Sanguinaria Canadensis.
7. Eythronium Americanum.
Thalictrum dioicum.
Anemone thalictroides.
Caltha palustris.
9. Viola primulæfolia.
Potentilla Canadensis.
Carex varia.
Arbutus uva ursi.

At Plymouth, Massachusetts, latitude 41° 57′ north.

April 29. Epigæa repens.
Oakesia Conradii.
Saxifraga Pennsylvanica.
Viola blonda.
Menyanthes trifoliata.

At Hubbardston, Worcester county, fifty-five miles west of Boston.

1837.
May 13. Epigæa repens.
Viola primulæfolia.
15. Trillium pictum.
Uvularia sessilifolia.
Clintonia borealis.
Coptis trifolia.
Carex acuta.
17. Fragaria Virginiana.
Vaccinium tenellum.
24. Polygala pauciflora.
Mespilus Canadensis.
Viburnum lantanoides.
26. Streptopus roseus.

At Topsham, Maine.

1838.
April 28. Hedyotis cærulea.
30. (Progne purpurea appears.)
May 1. Saxifraga Pennsylvanica.
2. Thlaspi bursapastoris.

Progress of spring at Fishkill Landing, Dutchess county, New York, latitude 41° 34′ north.

1838.
May 16. Peach orchards in blossom.
21. Lilacs in flower.
Anemone thalictroides.
Panax trifoliata.
Trillium erectum.
Viola pubescens, &c.
17. Apple, pear, and plum trees beginning to bloom.

1838.
May 22. Tupelo tree (*Nyssa multiflora*) in blossom.
Orchis spectabilis.
Cerasus obovata.
25. Cornus Florida.
Vinca minor.
Weather cloudy and cold.

The springs of 1840 and 1841 at Chelmsford, Massachusetts, four miles west of Lowell, Massachusetts.

1840.
April 7. Skunk cabbage (*Symplocarpus fœtidus*) in perfect flower.
15. Caltha palustris.
17. Houstonia cærulea, Carex varia, Thalictrum anemonoides.
May 30. Euchroma coccinea, Ranunculus acris, repens; Iris Virginica; garden peas in flower.

1841.
Mar. 19. Snow-drop (*Galanthus nivalis*) flowers.
27. Acer rubrum, Alnus serrulata, Corylus avellana.

1841.
April 2. Garden pansey blooms.
10. Crocus.
17. Epigæa repens.
29. Tussilago farfara.
May 5. Houstonia cærulea, Viola lanceolata, Thlaspi bursa pastoris, Taraxacum, Dens leonis, Thalictrum anemenoides, Narcissus pseudonarcissus, fl. pl., Mespilus Canadensis, Viola pedata, Van Thol tulips, hyacinths.

According to the Report of the Commissioner of Agriculture for 1862, the total number of bushels of Indian corn raised in the Union were (in 1860,) 827,694,528. The value of this single article of agriculture, so widely and universally cultivated, suggests the value of every form of knowledge which will bear upon the subject. To the State of Illinois in that year 115,296,778 bushels are accredited, or 5,111,913 bushels more than the State of Virginia, with a climate better suited to its growth. The state of Maine, with its northern winters and uncertain summers, produced, in round numbers, a million and a half of bushels, or nearly half as much as Florida, with the mean temperature of its year indicating the congenial soil of this valuable cereal. In such sections of country it becomes a serious consideration, when the corn-planting can be safely performed, and the hard work of spring done up. The probable minimum heat of the soil which will germinate Indian corn may be put down at 60° Fahr.; when the soil is only 45°, or perhaps 50° Fahr., the seed soon rots. There are other important crops under the market gardener's care which about this time claim attention; such are the squash, the melon, and the pumpkin, with the cucumber. These are tropical plants, native to South America, but for centuries cultivated by the aboriginal tribes, and through commerce distributed over the globe. By such means they have become, in some degree, acclimated, and lost, in part, their ardent nature, yet still germinating and growing to the best advantage with steady and continued heat. On this natural tendency to flourish under elevated warmth, the hot summers of the eastern coast of New England favor a growth which cannot be secured in the milder climate of England. Hence some cultivators postpone the sowing of the seeds of these valuable fruits into June, knowing, without any other data than the experience of repeated failure, that there is a connexion between the temperature of the atmosphere and that of the earth, when cold winds and freezing nights are no longer to be dreaded on the approach of balmy June. Could we seize upon the exact period, it would be wisdom "to observe the clouds," to note the bursting of the flower-buds, and to listen to the birds. Should we assume, by way of example, the monthly range of the month of May, respecting the mean atmospheric temperature, which we will suppose from 52° to 60° Fahr., might we not calculate that, by the third or fourth week, the open ground would have attained to a warmth of ten degrees higher than that of the air, at which time the blossoming of the apple tree and the lilac approaches or is consummated. Thus, by referring to our tables of flowering plants, &c., we find that, during a series of years, in a radius of not more than twenty miles, apple trees, including those growing in the most favorable situations, which would blossom first, and others observed when in full flower, have blossomed from the sixth to the thirty-first of May, when the mean temperature of the preceding, or of the same month, was 54° or 57°, and the lilac, for twenty-five consecutive years, blossomed from the eleventh to the thirtieth of May, at a mean monthly temperature of 54° or 55°. So, a full month earlier, the charming dwarf iris of the garden blossoms, and a week or ten days later the snowy medlar or shad bush whitens the swamps.

If one could find some hardy cultivated or wild plant that is widely distributed, we shall be able to note the difference in time which, in other latitudes or in wide-apart sections, *may* indicate an exact period we wish. I see, by the extensive and valuable "results of meteorological observations, made under the direction of the United States Patent Office and the Smithsonian Institution, from the year 1854 to 1859, inclusive," the part 1 of volume 2, that in twenty-six States the apple tree has a difference of blossoming, which ranges from March 3, at Greensborough, Alabama, in the year 1857, to June 16, at Newark, Vermont, and that the shad bush, or snowy medlar, blossoms from March 11, at Sykesville, Maryland, to June 9, at Brunswick, Maine, a difference of nearly three months! Even on the elevated plains of Kansas, as at Leaven-

worth, we find a difference of forty days earlier there than at Lawrence, in Massachusetts. In the 4th volume of the Memoirs of the American Academy may be found a paper from Jacob Bigelow, M. D., prepared at the suggestion of the distinguished Muhlenberg, of Pennsylvania, in reference to the forwardness of the spring. By it I perceive that the apple tree, in the year 1817, blossomed at Charleston, South Carolina, on the 4th of April; at Richmond, Virginia, on the 10th to the 18th of April; at Lexington, Kentucky, on the 10th of April; at Baltimore, Maryland, on the 14th of April; at Philadelphia, Pennsylvania, on the 22d of April; at New York, on the 4th of May; at Montreal, Canada, on the 25th of May; and at London, England, on the 8th of May.

We must not expect, in the opinion of the late celebrated botanist Oakes, "that the flowering of plants will accord very exactly with the *mean* of the thermometer for the several weeks and months of spring. The common native, and many of the cultivated herbaceous plants, will advance steadily, though slowly, in a moderate or cool temperature, especially if the ground is heated by the direct rays of the sun; while many trees, and some cultivated plants, such as Indian corn, beans, cucumbers, &c., will scarcely grow at all, unless the weather is quite warm; and in a few hot days they will make more progress than in as many weeks of cool weather.—(Hovey's Magazine for June, 1841.) The value of this testimony turns on the condition of the heat of the ground in an agricultural point of view, and I cannot but think that what we particularly need are accurate thermometrical observations respecting the subterranean warmth, to discover what relations the blossoming trees hold to it.

Allusion has been made to the leafing of the white oak as a guide. I have selected, as preferable, the blossoming of the apple tree and that of the shad bush, but it will do no harm to see how it stands with the white oak, (*Quercus alba,*) whose leaves expand simultaneously with its blossoms.

Little variation in the time of blossoming of these three examples, is noticeable throughout the New England and the western States; and a similar agreement of an earlier period, *i. e.*, from the middle of March to the middle of April, obtains in the rest, comprising in all twenty-four States of the Union, the geographical range being from Maine to Florida, and from Massachusetts to Kansas. It is, however to be cautiously considered, whether the white oak (*Quercus alba,*) is so widely distributed, or whether it is this species which in every instance is made the subject of record, or whether some allied species may not sometimes be employed.

This great and general uniformity, then, between these three common and conspicuous hardy plants is certainly striking, and at once conveys the idea that in the distribution of heat, isothermal belts rather than latitude are to be observed and studied. And if by the use of the thermometer, plunged into the soil, it should be found that there is some sure and uniform relation, evincing itself in the form of a law, just as we have seen that there is an intimate connexion between the heated atmosphere and the blossoming of *some* particular trees, perhaps we have arrived at the solution of one of our problems, and authenticated a natural fact worth knowing. I am assured by practical men that the warmth of the soil is of primary importance; that of the atmosphere is secondary; that if cold winds or slight frosts kill the young leaves of their corn, it is not lost, because it will sprout and grow again on return of warmer days, only let the earth at the roots retain its heat.

Again, it will be better to find some such few reliable instances than to depend on a mere general notice of the inflorescence of the spring. The eagerness to see the first symptoms of reviving activity betrays into loose and careless habits of observation. A precocious variety of the horse-chestnut, (*Æsculus hippocastanum,*) which I have watched for many years, was always in advance by many days of the rest of the trees of that species which stood side by side in

the same street. So it may be with the apricot, usually planted in some warm and sheltered corner. The aments of the willows and of the poplars extrude from their sheaths and show their downy scales on mild autumns, but these are no criterions of vernal weather, which finds them only ready to grow. No flower is really in blossom until it sheds its pollen or fructifying dust. Sometimes our ornamental shade trees, many of them removed from the woods and forests, grow too soon, and their tender foliage and shoots are blighted by freezing. One may see in the swamps the brakes and ferns blackened by frosts after they have unfolded their leaves; it was so last spring. We should reasonably imagine that nature would provide better, but she is a severe parent. So the gay procession of the flowers, appearing in regular succession, with an exactness on which a Thoreau could count their coming from the snow-drops in our gardens in March, or the erigenia of the Ohio woods, or the white erythronium and American pasque flower on the western prairies, first to greet the sun's genial rays, to the pæonies of early June, or the wild columbines on our rocky hills, and so to the wild geranium and blue iris, introducing summer, do no more than mark a temperature of the surrounding air. I have thought that self-sown seeds would be better monitors, having noticed that when the purple morning glory *(Convolvulus purpurea)* and the sun-flower *(Helianthus annuus)* appeared above ground, the tomato, a heat-loving plant, or the okra *(Hibiscus esculentus)* and the garden pepper will readily germinate, and the egg-plant would safely bear transplanting. The noble liverwort *(Hepatica triloba)* is reported from sixty-seven stations in twenty States, and evidently on the first opening of its flowers. It varies in time over that area full two months, or from the thirteenth of March to the fifteenth of May; but any one may find it in stations where it is abundant with a difference of three or four weeks' time in the same spring, according as it is looked for, in shaded places, or where it loves to nestle, among the black mould in crevices of dark-colored rocks, absorbing the sunshine and inviting it to blossom in advance. We can see, in its hardy nature and susceptibility to early blossoming, what, in effect, is similar to the flora of the Arctic regions, where, according to Dr. Kane, as far as 76° 25′ north latitude, grow, in protected nooks and amidst rocks, the polar grasses, saxifrages, scurvy grass, and species of buttercups, on the immediate level of the ice and snow, forming Arctic gardens of great beauty, warmed and quickened into life by the solar reverberations.

The information we have gained from Arctic vegetation is not without its application elsewhere. It confirms the general impression of the value of a snowy covering upon the ground where the winters are apt to be variable and severe, where alternate thaws and frosts may be the order of events. Doubtless the deep snows that some winters bring are excellent protectors to our orchards, maintaining an uniform temperature beneath the surface. Too severe freezing destroys trees, even the hardiest. The first warm snows of August and September, says Dr. Kane, enshrine the flowery growths in a non-conducting air-chamber, and before the intense cold of winter sets in, this light cellular bed is covered by drift-snow six to ten feet deep, in which the plant retains its vitality. The superimposed snow, becoming impacted and solid by increasing cold, forms a strong icy roof, and furnishes a channel or inclined plane among the rocks over which the icy water at approach of summer safely flows.—(*Arctic Exploration*, vol. 1, p. 266.) In the temperate zone no calculation can be based on the probable amount of snow, nor upon its specific character. Deep and durable snows occur only in mountainous tracts; the sudden moderation of weather after two or three days of severe frosts brings rains, which convert the snow into glacier ice, so to speak, freezing it upon the already frost-bound earth and destroying grass and grain—an occurrence so disastrous, it may be, that some farmers question the advantage of snow in early or mid-winter.

While nothing certain can be predicated on a cold and backward spring as

the token of a cold and unfavorable summer, so I apprehend little that is positive can be foretold of the nature of the coming summer from the previous winter. It is true that in some years cold summers have followed cold winters; for instance, the summers of 1836 and 1837, when no Indian corn ripened in Massachusetts. The summer of 1836 was preceded by a spring which was very backward at the beginning, *then very forward* until the twentieth of May. Neither has it been proved that backward springs exert any unfavorable influence on fruit or on crops. They are simply inconvenient to the agriculturist, particularly so if they are cold and wet, delaying the ploughing and planting, and crowding the spring work into a brief and hurried space.

The solicitude about the fruit crop, which is so natural, is apt to lead some cultivators into error. How common to be told that there will be no cherries, no peaches, or no pears. The most critical period is, however, in February and March, when rains are succeeded by great cold, which freezes the melting snow upon the branches and encrusts the flower-buds. Earlier than the last of February the cold does not seem to be much feared. A reduced temperature when fruit trees are in full blossom is not to be a cause of alarm. The expanded blossom has a raised temperature, several degrees higher than that of the open air. In some exotic plants this is surprising; in our fruit trees it exists to a greater degree than is imagined. A practical illustration occurs to me. A peach house, with the trees in full blossom, fell below the freezing point, and there were apprehensions of a total loss of the crop, but it proved to be as fair as usual.

It will be remembered that very warm spells of weather sometimes occur in January or February, and that danger to vegetation is apprehended in consequence. Thus, in the year 1828 the third week of February was so mild that the mercury stood at 50° to 57° each day. I recall some very warm, hazy days of February, 1832. At Medfield, (Massachusetts,) twenty miles southwest of Boston, in the year 1820, the mercury rose from 68° to 72° Fahrenheit on three successive days of March. From repeated experiments on the flower-buds of the hardiest native shrubs—for instance, *Cassandra calyculata*—I have found that at least a fortnight is needed to expand them at an average temperature of 45°. This shrub grows in cold, sphagnous swamps, frequently overflowed, and ordinarily blossoms in April. The aments of the willow, of the black alder, and of the hazel, will shed their pollen in a week or ten days' time if cut in the spring and kept in water over the mantel of the sitting room at a temperature of 70°. The flowers of the peach and cherry require the same conditions. The leaves of the Siberian spiræa unfold when similarly treated in eight days. These statements may be easily verified by cutting the branches or twigs in the winter, or in March, and immersing their lower extremities in water, which, acquiring the temperature of the room, excites the bursting of the buds. Caution must at first be observed that the exposure to heat be gradual, else the buds refuse to expand. No condition of the atmosphere can be imagined at unusual times of the year which, similar to these, could produce the same results; the more so when, unlike these parlor bouquets of living twigs, the fruit trees in the open air have their roots buried in a frozen soil.

Mr. Charles M. Hovey, an eminent nurseryman and fruit-tree culturist near Boston, asserts that "a week, a fortnight, or even a month of warm weather in December would have little or no effect upon well-ripened buds of trees. It is," he says, "their season of rest, and it requires a vast amount of heat to produce the least perceptible swelling of the buds. Four plants of the lilac, one of the most easily excited, were potted on the first of December and placed in a shed close by the furnace for a week. They were then removed to the hot-house, where the temperature was from 50° to 60° at night, and from 65° to 90° during the day; they were constantly watered and syringed, yet they showed no signs of swelling till the first of January, just four weeks from the time of potting. Here, then, we have an exact experiment, which, while confirming the

experience of gardeners in other instances, indicates that the season is more reliable than the temperature."—(*Magazine of Horticulture and Botany for February*, 1863, p. 49.)

The report of the Commissioner of Patents, in his "Results," &c., to which I have had frequent occasion to allude, suggests to me a caution which it is due to my subject to express here. It is elicited by the inferences drawn from such numerous data on every topic it considers. So, in urging the importance of exact data of the heat of the soil fit for germination of every kind of seed, and most favorable to successful growth, we must obtain through *multiplied instances* the information we seek. In illustration, I will refer to some garden notes on the spring of 1834. The mean temperature of the several months shows nothing extraordinary, but the early warmth of the atmosphere favored farm work in a remarkable degree. Warm and pleasant weather ushered in this spring. The ground was fit to plant on the 12th of April, and beets, onions, and potatoes were planted. On the 15th the mercury stood at 80° Fahrenheit, and in sheltered places near houses the plum trees opened a few flowers. On the 17th the air was smoky, the dwarf iris blossomed, the dust blew in the streets. Next day cucumbers planted a week ago were coming up, but on the morning of the 19th ice formed, succeeded by rain; on the 22d, a thunder-shower; on the 25th, ice formed in the shade *after* sunrise. May 1 invited further experiment, and kidney beans and Indian corn were essayed. On the 3d the white-breasted swallow arrived; the 11th brought thunder and considerable rain. The plum tree was in full flower on the 15th; two days after the mercury stood at 30° Fahrenheit, with wind and snow with ice; two days later the heat was renewed and elevated to such a degree that trees leafed out rapidly on that day; the elm trees shed their blossoms, and on the 24th the weather was that of dog days. The experiment of early planting was a failure; Indian corn, beans, squashes, cucumbers, melons, were all planted again at the end of May.

While in the preceding remarks I have endeavored to give due consideration to the natural phenomena of the seasons as they have arisen in my mind, I cannot leave this branch of my subject without alluding to other, which by some are regarded as suggestive "signs." Of these, the thickening of the husks on corn and the muskrats' winter abode are not uncommon.

With regard to the thick husks, the botanist shows that every part of a blossoming plant is a modification of the leaf. When these modified leaves are highly and beautifully colored, they are called bracts, corols, petals, perianth, perigone, or the like—all terms which signify exact differences of the same organs or parts of the flower. No parts of the entire plant are so liable to diversity and modification as these. The Indian corn is a tropical grass; its flowers are of two kinds, and are situated on different parts of the plant. The "spindle" or "tassel" is at the summit; it is composed of branchlets, and is what is termed a pannicle. Each of these branchlets, or lesser branches, is covered with multitudes of very small greenish flowers, each consisting of three chaffy scales, out of the middle of which issue three slender threads with transverse scales on their tips containing the dust or pollen, the same which, blown about in the air, "mixes" the varieties growing in neighboring fields. These panicled flowers are the male blossoms; the female blossoms are lower down upon the stalk. They, too, are lodged on a flowering branch which is usually simple, but sometimes branches again near the base. This branch is usually called the "cob," and upon its sides the female blossoms are arranged in "rows." Each flower consists of six chaffy scales, in the bosom of which a tender "germ," having on its top a long thread divided at its tip, may be seen. This "germ" will presently be the "kernel," but it must be swollen into growth by the dust or pollen lodging upon its silken thread. To protect so many delicate and tender germs, or incipient kernels of corn, the branch or cob, with its female flowers of kernels and threads, is carefully wrapped up in the "husks," which

are modified leaves or "bracts." They grow for this special purpose at the base or "butt" of the "ear," and are parts of the flowering branch, not present on the "spindle" or "tassel," because no protection is needed to the male flowers, which fall as soon as the dust has been shaken off by the winds. Every part of a blossom, being composed of modified foliage or green leaves, may be changed back again into leaves or forms of leaves by circumstances. We call these circumstances accidental, but that is only a term expressive of ignorance of causes. The flower garden can show us every season instances of flower buds changing into leaves, and full-blown roses with green buds growing out of their very centres. Sometimes, too, we see green leaves growing upon apples and pears, fruits which are the flower parts of trees. In unusually dry seasons, or in any season unpropitious to perfect growth, the effort on the part of plants is to provide for the seeds. It is then that certain parts of the flower are unduly developed, and if any part outgrows the rest, they must suffer. A thickened husk encloses sound grain, but the ear is somewhere deficient, its nutriment being absorbed by the husks. I had some Chinese pinks last summer which made flower stalks during the dry weather; their "bracts," or calyx leaves, multiplied themselves precisely as the husks do, and the consequence was that the blossoms suffered and were very deficient. Such, then, is the effect of drought, and the past summer produced much thickened husked corn. The summer of 1863 produced on some farms some thick husks. The coincidence of a severe winter favored the theory based upon last summer's experience, but it was falsified in the instance of the previous summer, which was succeeded by an unusually open winter. Heat, with abundant showers, will furnish thin husks and full ears; heat, with dryness, will give abundant husks and diminished ears. Would the farmer understand the phenomena of the seasons, let his avocations be elevated by scientific observation and thought.

With respect to the habits of the muskrat or musquash of the traders and Indians, (*Fiber Zibethicus*—Sabine,) its instincts teach it to build the floor of its hut above the water; should it fall, it is secure, but if it rises, a new layer is added, and the process thickens the walls. The result of such unusual industry is taken for sagacity and forethought.

A far more interesting series of "signs" may be gathered from the reappearance of the migratory birds. I am able to show in a tabular form the periodical return of several species through several years, indicating peculiarities of natural phenomena worth noticing. I have constructed it from notes taken at Salem, Massachusetts, through a longer period than are the observations in the "Results," &c.

REAPPEARANCE OF THE WHITE-BREASTED SWALLOW, (*Hirundo bicolor*, Vieillot,) *with mean heat of some months.*

Year.	Day of month.	Mean of February.	Mean of March.	Year.	Day of month.	Mean of March.	Mean of April.
		° ′	° ′			° ′	° ′
1832....	March 23	28 30	36 61	1836...	April 9	32 45	44 02
1833....	" 19	25 64	32 44	1837...	" 3	32 24	45 03
1834....	" 4	33 75	37 31	1838...	" 5	36 70	42 33
1835....	" 21	25 20	33 57	1839...	" 1	36 58	48 42
1840....	" 28	34 27	37 43	1842...	" 3	40 49	46 96
1841....	" 25	26 58	36 04	1843...	" 13	29 05	45 85
1845....	" 30	28 15	37 96	1844...	" 12	36 93	50 73
1846....	" 27	23 83	38 87	1847...	" 5	32 82	44 27
1848....	" 29	28 53	35 02	1850...	" 3	.....	.....
1849....	" 31	22 89	38 22	1852...	" 24	.....	.....
1851....	" 28	.....	.....	1855...	" 7	.....	.....
1853....	" 29	.....	.....	1856...	" 8	.....	.....
1854....	" 16	.....	.....	1857...	" 5	.....	.....
1858....	" 31	.....	.....	1859...	" 7	.....	.....
1860....	" 31	.....	.....	1862...	" 4	.....	.....
1861....	" 29	.....	.....	1863...	" 6	.....	.....
				1864...	" 14	.....	.....

REAPPEARANCE OF THE BARN SWALLOW, (*Hirundo horreorum.*—Baird.)

Year.	Day of the month.	Year.	Day of the month.	Year.	Day of the month.	Year.	Day of the month.
1840....	April 19	1848...	April 26	1860...	April 27	1835...	May 6
1841....	April 26	1849...	April 29	1861...	April 25	1838...	May 3
1842....	April 22	1850...	April 27	1862...	April 20	1851...	May 4
1843....	April 27	1853...	April 25	1863...	April 31	1852...	May 2
1844....	April 26	1855...	April 27	1832...	May 4	1854...	May 2
1845....	April 27	1856...	April 19	1833...	May 14	1857...	May 1
1846....	April 23	1858...	April 25	1834...	May 5	1864...	May 2
1847....	April 21	1859...	April 29				

The chimney swift (*Chætura pelasgia*) appeared on the 9th of May, 1863.

The white-breasted swallow is the first bird that brings to the city the news of spring. It takes immediate possession of any contrivance invented for its accommodation in the close proximity to our dwellings. The robin, (*Turdus migratorius*, *L.*,) notwithstanding its name, scarcely leaves us in winter, being seen in the deep cedar woods and approaching the gardens on flight of winter for food. The swallows all migrate in September, and are to be seen in abundance in Louisiana or on the shores of the Pacific. The precise food the swallows find so early I am unable to ascertain, but dipterous insects are early hatched and take the wing. The barn swallow, according to Wilson, feeds on the house fly, which is an early visitant. Some attention to the food of migratory birds, on their return in the spring, would be advantageous to science and perhaps to agriculture.

REAPPEARANCE OF THE BLUE BIRD, (*Sialia sialis.*)

Year.	Day of the month.	Year.	Day of the month.	Year.	Day of the month.	Year.	Day of the month.
1845....	Feb. 25	1840...	March 4	1850...	March 1	1857...	March 16
1860....	Feb. 28	1841...	March 25	1851...	March 5	1858...	March 17
1861....	Feb. 27	1842...	March 4	1852...	March 13	1859...	March 13
1833....	March 19	1844...	March 13	1853...	March 19	1862...	March 24
1835....	March 21	1846...	March 15	1854...	March 2	1863...	March 26
1836....	March 31	1847...	March 16	1855...	March 24	1864...	March 13
1838....	March 28	1848...	March 19	1856...	March 23	1843...	April 7
1839....	March 22	1849...	March 18				

REAPPEARANCE OF THE SPARROW, (*Spizella socialis.*—Bon.)

Year.	Day of the month.	Year.	Day of the month.	Year.	Day of the month.	Year.	Day of the month.
1835....	April 30	1847...	April 16	1853...	April 11	1859...	April 19
1840....	April 22	1848...	April 9	1854...	April 13	1860...	April 16
1841....	April 22	1849...	April 20	1855...	April 18	1861...	April 17
1842....	April 16	1850...	April 20	1856...	April 11	1862...	April 18
1843....	April 21	1851...	April 22	1857...	April 23	1863...	April 13
1844....	April 10	1852...	April 23	1858...	April 16	1864...	April 14
1845....	April 16						

REAPPEARANCE OF THE WREN, (*Troglodytes ædon.*—Vieillot.)

Year.	Day of the month.	Year.	Day of the month.	Year.	Day of the month.	Year.	Day of the month.
1833....	May 7	1844...	May 4	1853...	May 5	1859...	May 6
1834....	May 7	1845...	May 5	1854...	May 6	1860...	May 10
1835....	May 9	1847...	May 5	1855...	May 15	1861...	May 4
1839....	May 7	1848...	May 4	1856...	May 14	1862...	May 11
1840....	May 3	1850...	May 4	1857...	May 23	1863...	May 5
1841....	May 19	1851...	May 3	1858...	May 8	1864...	May 11
1842....	May 1	1852...	May 11				

The wren feeds on spiders and small worms, for which it is actively engaged in the garden, among the shrubs, currant and gooseberry bushes, and corners of the fences.

REAPPEARANCE OF THE SUMMER YELLOW BIRD, (*Dendroica æstiva.*—Baird.)

Year.	Day of the month.	Year.	Day of the month.	Year.	Day of the month.	Year.	Day of the month.
1832....	May 4	1842...	May 4	1850...	May 7	1858...	May 10
1834....	May 8	1843...	May 7	1851...	May 11	1859...	may 6
1835....	May 14	1844...	May 2	1852...	May 8	1860...	May 6
1836....	May 8	1845...	May 1	1853...	May 5	1861...	May 4
1837....	May 8	1846...	May 2	1854...	May 10	1862...	May 11
1839....	May 1	1847...	May 5	1855...	May 9	1863...	May 10
1840....	May 2	1848...	May 4	1857...	May 7	1864...	May 7
1841....	May 11	1849...	May 7				

The summer yellow bird makes its appearance as soon as the fruit trees begin to blossom, its food being small beetles and those insects which are found in the flowers. Other allied genera and species, known as warblers, are only birds of passage, while this takes up its residence with us and builds and rears its offspring among our shade trees and garden shrubs.

REAPPEARANCE OF THE GOLDEN ROBIN. (*Icterus Baltimore.*—Daud.)

Year.	Day of the month.		Year.	Day of the month.		Year.	Day of the month.		Year.	Day of the month.	
1832....	May	10	1842...	May	8	1851...	May	11	1858...	May	10
1833....	May	7	1843...	May	10	1852...	May	8	1859...	May	14
1834....	May	8	1844...	May	2	1853...	May	5	1860...	May	7
1835....	May	12	1846...	May	3	1854...	May	10	1861...	May	11
1838....	May	3	1847...	May	10	1855...	May	10	1862 ..	May	11
1839....	May	7	1848...	May	7	1856...	May	14	1863...	May	11
1841....	May	12	1849...	May	5	1857...	May	14	1864...	May	12

The golden robin feeds on insects, in search of which it pulls off the blossoms of the cherry and aids in thinning the tree of any exuberance of flowers. Its utility as an insect-eating bird cannot be questioned, feeding on larvæ, caterpillars, and beetles generally, and varying its diet with ripe fruit or green peas, which it fairly earns. It passes the winter months in South America.

REAPPEARANCE OF THE BOB-O'-LINK, (*Dolichonyx oryzivorus.*)

Year.	Day of the month.		Year.	Day of the month.		Year.	Day of the month.		Year.	Day of the month.	
1843....	May	10	1847...	May	11	1858...	May	12	1861...	May	9
1844....	May	10	1848...	May	15	1859...	May	13	1862...	May	14
1845....	May	8	1854...	May	13	1860...	May	11	1863...	May	12
1846....	May	13	1857...	May	12						

The bob-o'-link of the New England States is the reed bird or rice bird of the south in its winter plumage. It is a busy, insect-eating bird, and a general favorite. Its food is grasshoppers, beetles, &c., varied with oily seeds, as the dock, &c.

REAPPEARANCE OF THE KING BIRD, (*Tyrannus Carolinensis.*)

Year.	Day of the month.		Year.	Day of the month.		Year.	Day of the month.		Year.	Day of the month.	
1847....	May	11	1858...	May	24	1861...	May	19	1863...	May	21
1856....	May	15	1859...	May	30	1862...	May	19	1864...	May	11
1857....	May	10	1860...	May	18						

The king bird has been observed to return on the appearance of the dor-bug, or dor-beetle, or May beetle, (*Lachnosterna quercina*, Hope, on which it greedily feeds,) a destructive insect, both in its winged and larva states. Its pugnacious disposition renders it a favorite in the poultry yard, driving away the sparrow hawks and similar rapacious birds.

The purple finch (*Carpodacus purpureus*, Bd., *Fringella purpurea*, Wils., Aud., Nutt.) is a chance visitor, arriving in flocks from the south quite early in the spring to feed on the seeds of the larch and on berries of shrubs in the gardens. Its arrival does not indicate any decided advance of the season, but only scarcity of its food, which it seeks elsewhere. It was seen feeding on the larch cones on the 23d of March, 1863.

I need not dwell upon the utility of the birds to agriculture, believing, as I do, that there are none wholly without value in the labors and pursuits of farming. The aptness of so few of them I have cited to be present with their assistance at a most important season, will be readily seen by comparison of the dates of their arrival with the dates of blossoming and leafing of trees and plants. Fuller details in the same manner would, I doubt not, give still more interesting and satisfactory results. Every species of bird has, like every species of plant, a geographical range of life and existence. Their migratory habits are the results of an instinct to build their nests, rear their young, and seek suitable food. The same instinct prompts them to find again their former haunts year after year, until some fatal cause destroys them. The purple martin (*Progne purpurea*, Bd.) is now very rare in this vicinity; once it was a common and welcome visitor, and every one vied to furnish it with suitable accommodation. A long and continued cold rain storm, together with the want of suitable food in consequence of the unfavorable weather, killed them by scores, and few have been seen since. All the species of swallows are friendly to us; their food must consist of insects with soft wings; and there is a host of two-winged flies which are early on the wing, some of which, like the wheat-fly, or Hessian fly, (*Cecidonya destructor*,) and similar species, are doubtless checked in their increase. A friend well informed on insects assures me that from a hole in a martin's box which had been erected several years he took a quart of wing cases, &c., of the cucumber-bug, or squash-beetle, (*Galeruca vittata*,) the rejectamenta or orts of the food of this bird. The food of the elegant and companionable blue bird consists, as we are assured by Nuttall, of the *Iulus*, a myriapod insect usually known as *wire-worm*, so destructive to ripening fruit which lies upon the ground; other insects are also eaten by the species. The king bird is supposed to be fond of honey-bees, but it is alleged by an observant friend of mine that he does not make his call upon us until the dor-bug or June-bug is abroad in the warm air—a singular coincidence, at least. Early in the warm days of March and April several species of grasshoppers are to be seen, which are sought by the returning birds. They are then wingless, being in a larva or pupa state. The crow, (*Corvus Americanus*, Audubon,) the bird hated by farmers and deemed an outlaw, feeds largely upon the larva or "grubs" of the Melolonthada, to which family the May-bug and other leaf-eating beetles belong, and does not disdain the perfect insect in its repast. A large flock of crows was noticed on one side of a road, and none in the fields on the opposite side. Examination of the premises showed that the spot of their visit was a grassy pasture infested with grubs. It is in quest of these fat and delicious morsels, and of the gray cut-worm, (*Agrotis*, Harris,) that the corn-fields, when the grain is coming up, are visited with such pertinacity, the grubs and larvæ being more or less abundant near its roots. The crow builds in March; the young birds are in a condition to require nutritious food about that time, and parental solicitude and instinct prompt it to seek where it can be obtained. Were it the kernels of corn that it sought, wisdom would suggest the scattering of an occasional peck over the field, and thereby save the sprouting seeds. The search for nests and young birds of other species might save them from much odium as destructive to the farmer's anticipations and hopes. The boy who shoots a crow does not think it worth his while to open its stomach to find the amount of pilfered corn; so the other contents are unknown. Farms and gardens alike, where every species of birds are protected, are made their favorite

haunts, and are freer from all sorts of destructive insects. I knew one farm where the skunk (*Mephitis Americana*, Desmarest) was protected as a useful animal in the corn-fields, visiting them in the night in quest of grubs and larvæ, and cut-worms. Better and more intimate knowledge of the animals, and birds, and insects, which so assiduously follow man and live near his dwellings, is the only way by which we can learn the intimate relations that subsist between our labors and the phenomena and facts of nature.

In like manner the indiscriminate slaughter of insects pursued by most people indicates thoughtlessness or wanton sport. Some of the larger beetles are carnivorous and insect-eaters, and are found in situations where their predatory habits could be put to useful employment. Others, of smaller proportions, cause the death of injurious caterpillars by stinging them, to deposit their eggs within the body. Some acquaintance with such facts will save many persons from mortification and regret.

I should have been gratified could I have presented in this essay extensive tables of the seasons of insects, as I have of plants and birds. This, however, has been initiated in the "Results."

To render essential service to agriculture we likewise need similar tables of the precise times for harvesting every sort of crop throughout wide apart districts of our country. The maladies incidental to every vegetable under cultivation are worthy of study, record, and general observation. Very little is known among cultivators about the different species of the fungi which infest every plant in some part of its structure. It is not uncommon to find in our American magazines of agriculture, or in some newspaper, a valuable communication respecting the injury to fruit, or to seed, or to the growing plant, but which is attributed to a fungus, mould, mildew, or the like, described abroad by some learned botanist, and mistaken as the cause, subsequent analysis showing that it has no relation. Many if not most of these vegetable parasites which prey upon our valuable crops are purely American, and belong exclusively to our climate. The *oidium*, or mildew, which destroys the foliage of the vines of Europe is not the one which disfigures and crisps the larger and coarser leaves of our hybrid grapes. The origin of *smuts* on grain is imperfectly understood; the reason why, in certain soils, these parasites are more propagated in crops has not been apprehended, and popular errors abound. So, it is not by any means certain whether foreign insects are introduced, or whether such are not indigenous, but not before noticed; or how far do mere climatic influences operate in the production of the crop, and by what means or how long the required time to acclimate species from other countries. Is nothing to be learned from older modes of cultivation, or gathered from the methods pursued by various tribes of men?

Considerations of this kind have not been beneath the notice of the most distinguished men of science. Much of our agriculture is experimental, without any certain base of operation. Abroad, the very limits of possibility are defined—at what altitudes, in what regions plants will grow, is known; where the vine will best flourish, where it will perfect fruit, where it will produce wine. We want the same exactness here; want to know where to expend our labor to the best advantage. The area of our country opens a wide field to every kind of agriculture. There is nothing worthy of expense and toil that cannot find the climate appropriate. Who dreamed of the vast results of the trial of a sample of cotton seed in the southern soil? Who can estimate the increased revenue from that plant under free labor in more northern latitudes, where the temperature of the year will allow its growth? Who can foretell the limit to the cultivation of tropical products in Florida, suggested by the unsuccessful appeals of Perrine in 1838? Who can estimate the possible fertility of that State after perusing such an article as found in the report of the Commissioner of Agriculture for 1862, page 59? Who shall tell the results of the modest

labors of those who hybridize, who select, who invent, as it were, new forms of animal and vegetable existence, and with lavish generosity scatter them broadcast over the world?

As civilization pushes itself across our continent, it settles the vast plains and table-lands of the west, pressing onward to the Pacific shores. Shall an intelligent improvement of the soil be rendered available to the immigrant who seeks there a home? What new lessons to be gleaned there from other and diverse phenomena of nature! What is to be learned of the constituents of the soil from the prevalence of the winds, the winter's frost, the summer's heat, the moisture of the air, the geological structure of the river beds, the liability to drought, the fitness for this or that kind of cultivated plant, or what promise to new enterprizes? To what extent shall its sparse forest trees be swept away, or its wide acres be artificially planted with useful timber? How will a judicious agriculture or a heedless, careless, and empirical one affect its future climate, and fit it for the abode of a highly cultured people? These, and similar, are questions of grave moment; they are worthy of a great and prosperous nation's thought; they bear upon the destiny of the race.

THE "GAME BIRDS" OF THE UNITED STATES.

BY D. G. ELLIOT, OF NEW YORK.

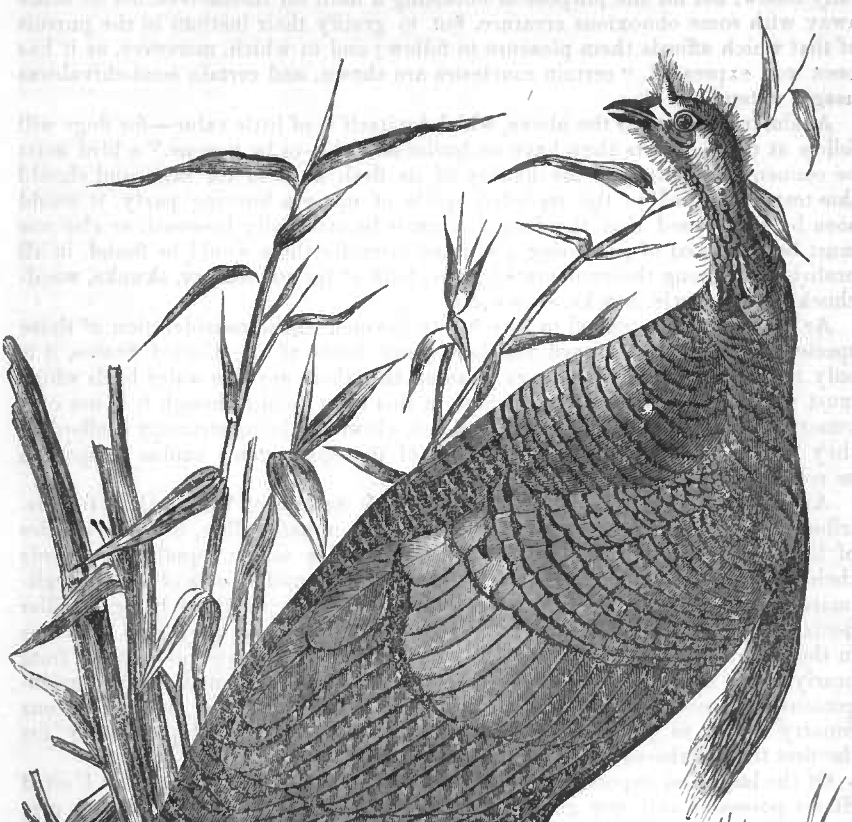
THE amount of food as furnished by the "game birds" of this country to the people of every class makes the consideration of their economic value one of much interest. It is a matter of regret that though circulars were addressed to many individuals and corporations to ascertain the amounts shipped to other markets or consumed at home, no reliable estimates were returned.

What is a "game bird" is truly a difficult question to answer even in this enlightened age, when, in the estimation of very many, everything that may be possessed of feathers, and which, in the sportsman's parlance, can be "brought to bag," is considered as legitimate *game*. But in fact the number of birds which in this country are fairly entitled to be so classed is very small, in comparison with those which are daily mercilessly slaughtered by the majority of "gunners," and exposed on every poultry vendor's stall in our markets.

Not indeed every feathered biped, which a high breed of dogs will instinctively point, can be included in our list; for the meadow lark, (*Sturnella magna,*) that troublesome pest of every true sportsman, whose dog, unless taught otherwise, will surely follow, has fairly no claim to this title, any more than have a turtle or a snake, to either of which a point will generally be made, and these last, it is hardly necessary to add, are neither birds nor game.

And so we return to the place from which we started to ask what constitutes a game bird in the true sense of the term? What is there so peculiar about a certain number of these animals as to single them out from their fellows, and be deemed worthy of a distinctive appellation? The question is seldom answered satisfactorily, for every individual who may be more or less interested in its solution has his own ideas of the manner in which the reply should be made. Nor do I expect to be able to give one that will be deemed correct by all of those who may perchance read these lines; but strictly, it appears to me only

PLATE X



WILD TURKEY.

those birds can be esteemed as "game" which certain breeds of dogs will naturally follow, not for the purpose of obtaining a meal for themselves, nor to make away with some obnoxious creature, but to gratify their instinct in the pursuit of that which affords them pleasure to follow; and to which, moreover, as it has been well expressed, "certain courtesies are shown, and certain semi-chivalrous usages extended."

Again, in addition to the above, which by itself is of little value—for dogs will follow at times objects they have no business with—to be "game," a bird must be eminently adapted by the quality of its flesh as food for man, and should this test be applied to the recorded spoils of many a hunting party, it would soon be discovered that the long list must be materially lessened, or else one must be convicted of possessing a vitiated taste, for there would be found, in all probability, among the enumerated game, both of fur and feather, skunks, woodchucks, coons, owls, hawks, crows, &c.

As this essay is intended to be entirely devoted to the consideration of those species which may be termed the land game birds of the United States, it is only necessary for me to state, *en passant*, that there are also water birds which must with equal propriety be included in this class; and although it is not customary to hunt these always with dogs, yet, whenever the opportunity is afforded, they will receive the respectful attention of the sportsman's canine companion as readily as do the partridge and grouse.

America has been highly favored among the nations of the earth in the distribution over her vast expanse of mountain, plain, and valley, of many species of birds peculiarly qualified to be included in this article, equally as regards their variety, and as affording suitable food for man, and also as objects of legitimate sport. Many of these are well known to everybody as being familiar denizens of our cultivated districts, pleasing to the eye as they pass before us in their hurried flight, or making the air vocal with their love-notes uttered from nearly every coppice in the merry month of May, and protected (?) by laws ingeniously framed for that purpose; while others, inhabiting portions of our country hardly as yet fully explored, will be presented, in all probability, for the first time to the consideration of many of my readers.

Of the large and important family of the *Phasianidæ* or pheasants, the United States possesses only one genus, but that one containing its most valuable representatives. I would here remark that there does not exist in this country any true pheasant, and any bird which may perchance be so called, within the limits washed by the two great oceans, simply appears under false colors. Lest I may be misunderstood in the above remark, I would explain that what I meant by *true pheasants* was those species included by Gray in his second sub-family of *Phasianidæ*, and which "have the tail more or less lengthened, greatly cuneated, and composed of narrow and cuneated feathers," all the members of which are natives of the eastern portions of the Old World, and from which this great family, including as it does many varieties of forms, derives its appellation.

The species first to be considered, and which takes a rightful precedence over all those to be enumerated in this article, both as regards its importance in furnishing nutritious food to man, and as being entitled, in every sense of the term, to be held as "game," is that one known to science as

WILD TURKEY, (*Meleagris gallopavo.*)

This magnificent bird, although now found almost throughout the globe, by the processes of domestication and naturalization, is one of the many gifts America has given to the world; which fact at one time was nearly forgotten, as its origin was involved in some obscurity, and doubts expressed as to its native country. Thus, such men as Belon, Aldrovandi, Gessner, Ray, &c., thought that it came originally from Africa and the East Indies, and endeavored to re-

cognize it in some of the domestic birds of the ancients. "In so losing sight of the origin of this bird, we see a strong exemplification of the ungrateful disposition of man, who can durably treasure up the memory of wrongs and injuries, but fails to recollect the greatest benefits he has received."

The turkey was first introduced by the Spaniards from Mexico into Spain, and thence carried to England. In the reign of Francis the First they were imported into France, and the first one eaten in that country was served up at the banquet given at the wedding of Charles the Ninth, in 1570. Bred with much care they rapidly increased, and soon were taken into Asia and Africa. It would be difficult to ascertain why its popular name was given to this bird, and it is to be somewhat regretted that such an appellation should ever have fallen to its lot, since it is apt to give rise to the supposition that it originated in Asia instead of America, the eastern in place of the western hemisphere. Not so much to be regretted, however, at the present time as formerly, for, since ornithology has taken its rightful place among the sciences, and its hidden things are investigated and explained by the researches of so many able minds, the results of whose labors dignify and elevate their subject, the origin of so noble a bird is not likely ever again to be lost sight of. At one time the turkey was pretty generally distributed throughout the United States, but, like the Indian, it has gradually disappeared before the onward march of civilization, until now one must look for it amid the unsettled portions of our western States, and the vast regions through which the Mississippi, Missouri, and their tributaries flow. It is still quite plentiful in the southern States, many parts of which are yet covered with the virgin forest, while in the middle and northern States it has almost if not entirely disappeared.

My limits will not permit me to enter upon a full description of the habits and economy of this species, and I will therefore only touch on those points which would seem to be most important and interesting.

The turkey may be considered as both migratory and gregarious; the first of these circumstances arising mainly from the exhaustion of their favorite food in any particular section of country, or upon the opposite fact, of there being a great abundance of it in some other place. When this last is the cause of their migration they seem to be insensibly led towards the land of plenty by finding the supply increase as they advance, and not from any particular instinct of their own. Their food consists of maize, berries, fruits, grasses, acorns, and in that part of the country where it abounds, the pecan nut is preferred by them to everything else.

When migrating, if they reach a river over which they desire to cross, they generally remain near the bank for a day or two previous to making the effort; seemingly either to consult upon the means of accomplishing their intention, or to recuperate their strength before undertaking the difficult feat.

While they are thus waiting the males employ their time chiefly in gobbling continually, or in strutting pompously about with lowered wings and expanded tails, the females sometimes even imitating them in these movements. When they consider that the time has arrived for proceeding on their journey, the entire flock mount to the tops of the highest trees, and, at a given signal of their leader, launch themselves into the air and fly to the opposite shore. The old birds easily cross, but should the stream be wide, the young and feeble frequently miss the desired point and fall into the stream, when they proceed to swim ashore, which they accomplish with considerable dexterity by closing their wings, using their expanded tails for support, and striking out rapidly with their long and powerful legs. Sometimes, if the shore should be very steep, some are unable to ascend, and, falling back from their unsuccessful attempts, perish in the water.

Toward the latter part of February, what may be termed the love season commences, and, strange as it may appear, the females separate and endeavor to hide

from the males, while the latter, with almost unintermitted gobbling, seek for them in all directions.

At this season of the year I have heard the rolling notes of the males in the early morning resounding from every side, as they stood upon their perches, until, on the appearance of the rising sun, they ceased calling, and silently sought the ground, where they began to strut about, evidently hoping that the eyes of some watchful female observed their lordly bearing.

Whenever the males meet while thus occupied, fierce battles ensue, ending, generally, in the death of the weaker party, unless he is fortunate enough to escape by flight. Of these fights Audubon says:

"I have often been much diverted while watching two males in fierce conflict, by seeing them move alternately backward and forward, as either had obtained a better hold, their wings drooping, their tails partly raised, their body-feathers ruffled, and their heads covered with blood. If, as they thus struggle and gasp for breath, one of them should lose his hold, his chance is over; for the other, still holding fast, hits him violently with spurs and wings, and in a few minutes brings him to the ground. The moment he is dead, the conqueror treads him under foot; but what is strange, not with hatred, but with all the motions which he employs in caressing the female."

The males do not always confine their attentions to one female; sometimes several of these may be seen accompanying one gobbler, until they commence to lay, when they hide themselves for the greater part of the day in order to save their eggs, which he would destroy whenever he obtained the opportunity. The nest, a very simple structure, is generally placed in some thicket to conceal it from the prying eyes of its various would-be despoilers, and the hen approaches it with great caution, rarely entering it twice from the same direction. The number of eggs deposited varies considerably, some nests having ten, others as many as twenty. They are of a dull cream color, profusely sprinkled with red spots. The young, when first hatched, are covered with a delicate hairy down, and are very tender; so susceptible to the influence of the weather that, should the season be rainy, great difficulty is experienced by the hen in raising them, for they rarely survive a thorough wetting. To guard against such a catastrophe the first night is generally passed by the young brood in the nest, and the mother then leads them to elevated dry places, reposing them at night under her outspread wings until they are two weeks old, when they roost upon the broad branch of a tree, still covered, however, by their watchful parent's wings.

The turkey has many enemies beside man, and among those most feared by it are, perhaps, the lynx and great-horned owl. The former sucks their eggs, and seizes both the young and old birds, his stealthy, noiseless progress enabling him to approach even so wary a bird unnoticed. The owl is equally dreaded, his soft plumage permitting him to fly about their roosting place without a sound, like some midnight sprite. The manner in which his attacks are evaded is both ingenious and successful, and is accomplished in the following way:

As soon as the warning cluck of some watchful turkey has placed the whole number on their guard, they immediately stand upright upon the limb and observe every movement of their foe, who, soon selecting one of them for his prey, swoops upon it with the velocity of an arrow, and it would seem that the fate of that one was inevitable; but as rapid as was the owl's movement, still quicker is that of his intended victim; for, lowering his head and inverting his outspread tail upon his back, he meets his enemy with this inclined plane, over which he glides harmlessly, and the turkey drops to the ground and insures his safety by running away.

Any unusual object attracting the attention of the male seems to throw him into a state of considerable excitement, and he puffs himself up very much in the same manner as when strutting, and the wattles which cover his neck become bright red from the sudden influx of blood. Sometimes a red cloth will excite his anger, and cause him to exhibit pugnacious propensities.

Many are the means employed to obtain possession of these birds, some of

which are too often eminently successful, and also equally reprehensible, and although there may be instances, when turkeys are very numerous, that they may, to a limited extent, injure the growing crops, yet they are never so destructive as render their almost complete extermination necessary. Many are trapped, sometimes whole flocks captured at one time in pens constructed for that purpose; and in some parts of the country man's ingenuity is exhausted in endeavoring, seemingly, how to arrive, in the shortest possible time, at their complete extinction. I propose to consider this part of the subject more fully in another place.

The turkey is an extremely shy bird, taking alarm at the slightest sound; hence it can be readily understood how they would naturally shun man's presence, and prefer the depths of our great forests, or the solitude of the vast plains, and that, as a matter of course, they should become scarcer as the population near them increased, even though artificial means should be wanting to lessen their number.

Audubon states that when he removed to Kentucky, rather more than a quarter of a century ago, turkeys were so abundant that the price of one in the market was not equal to that of a common barn-fowl now; and that he has seen them offered for the sum of three pence each, the birds weighing from ten to twelve pounds.

The average weight of this splendid bird is about fifteen to eighteen pounds (I speak of the male,) and the female from nine to ten. Some gobblers have been known to weigh much more than this estimate, and instances are not wanting when individuals have been obtained weighing thirty and forty pounds each; but this is rare.

When full grown the male will measure four feet in length and nearly five feet in the stretch of its wings. The naked skin of the head and neck is blue, with the wattles red, as are also the legs. The feathers of the neck and body generally are a coppery bronze, changing in some lights to a greenish or purplish shade, and margined with an opaque line of velvet black.

The back and rump are also black, with little reflection, while the sides, together with the upper and under tail coverts, are dark chestnut, barred with black near the end, and having metallic reflections of a rich purplish hue, while the extreme tips are opaque purplish chestnut.

The tail feathers are dark chestnut barred with black, and tipped with a light chestnut. Near the end is a band of black, broadest on the outer feathers, and narrowing as it approaches the central ones. Between the bars on the feathers is a confused sprinkling of black.

Neither upon the tail nor its coverts is there any white, and this is one of the ways by which the wild bird can always be distinguished from the domesticated. From the centre of the breast hangs a long coarse hairy tuft, sometimes not found in the other sex.

The female differs principally in being smaller in size, less brilliant in coloring, absence of the spur, and the small fleshy process at the base of the bill.

Up to the present time but three species of this genus are acknowledged generally; the second to which I will briefly refer is that one known as the

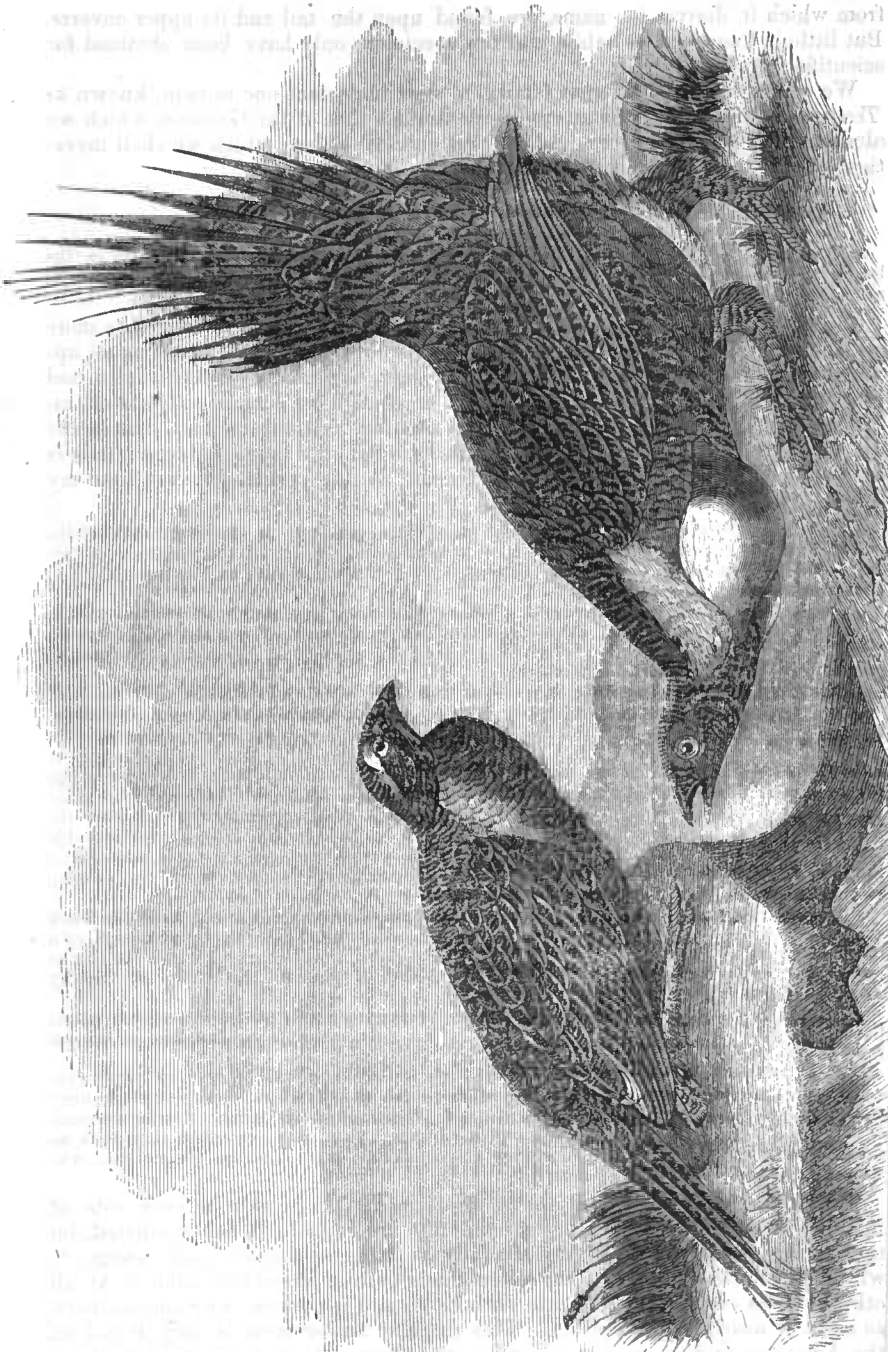
MEXICAN WILD TURKEY, (*Meleagris Mexicanus*,

an inhabitant of New Mexico, resembling the preceding bird so closely that it would probably be considered identical by the casual or unscientific observer, and its habits are also similar. But the third species, called

OCELLATED TURKEY, (*Meleagris ocellata*,)

a native of Honduras and other parts of Central America, is one of the most beautiful birds known to ornithologists, its feathers fairly blazing with metallic reflections of gold, green, blue, and bronze, while four series of ocellated spots,

PLATE XLV.



from which it derives its name, are found upon the tail and its upper coverts. But little is known of its habits, and few specimens only have been obtained for scientific purposes.

We now come to a different family, a very important one to man, known as *Tetraonidæ*, including among other sub-families that of the GROUSE, which we alone have now to consider; and the first species of these which we shall investigate is the comparatively little known

COCK-OF THE-PLAINS, (*Centrocercus urophasianus.*)

"North America," says the Prince of Musignano, "is exceeded by no country in the beauty, number, and valuable qualities of her grouse; and she is even, perhaps, superior to all others in these respects since the discovery of the cock-of-the-plains."

A fact at the present day beyond dispute; for this country possesses more species of grouse than all the rest of the world together, a benefit not at all appreciated by its people now, nor will it be, I fear, until many of the birds treated of in this paper, through wanton destruction, shall have become subjects of tradition; and the "oldest inhabitant" will mention, as a curious fact, that in the recollection of *his* parents such strange birds were once found in large numbers in certain districts. The following account of this species is taken from my monograph of this family.

"This splendid bird, for its great size, stands pre-eminently in the front rank of the American grouse, and is only exceeded in that particular, among all the members of this family, by the stately European cock-of-the-woods (*Tetrao urogallus*) and its near ally (*T. urogalloides.*)

"The sage cock, by which name it is also known, is never observed in the eastern portion of our continent, but dwells on the vast plains which lie on both sides of the Rocky mountains, and wherever, on those almost endless tracts, the sage bush (*Artemisia tridentata*) grows, there the cock of-the-plains abounds.

"The flight of this species is strong, and at times well sustained; it rises with the loud whir-r-r peculiar to this class of birds, and progresses by alternate flapping and sailing, generally in a straight line until hidden by a hill, or lost to the eye in the far distance.

"The courting season commences in the early spring, generally March or beginning of April. At such times, about sunrise, the male, perched upon some hillock, lowers his wings until the primaries rest upon the ground, spreads out his tail like a fan, and with the gular sacks inflated to a prodigious size, and head drawn back, he struts up and down before the admiring gaze of the assembled hens; then lowering his head until it is on a level with his body, he exhausts the air contained in the sacks, producing a loud, grating noise, resembling hurr-hurr-r-r-hoo, ending in a 'deep, hollow tone, not unlike the sound caused by blowing into a large reed.'

"The nest, formed of twigs and grass, is always placed upon the ground, near the bank of some stream, or sheltered by low bushes. The hens lay about fifteen or sixteen eggs, of a dark brown color, spotted on the larger end with chocolate. In about three weeks the chicks appear, and, like all of this family, run as soon as they are hatched, deserting the vicinity of the nest in a few hours.

"During the summer and autumn these grouse go in small flocks, sometimes only in pairs; but in the winter and spring they congregate in immense packs, to the number of several hundred, and roam over the prairies in quest of subsistence.

"Their food consists chiefly of the leaves of the artemisia, which, being very bitter, renders their flesh strong, and at times utterly unfit to eat, thus often depriving some hungry traveller on the plains of what promised him a delicious and savory meal. In the autumn, according to Nuttall, they frequent the streams of the Columbia river, when they feed on the pulpy-leaved thorn, at which time they are considered good food by the natives, who take great quantities of them in nets."

The gular sacks, mentioned above, are formed of loose skin on each side of the neck, which, in the breeding season only, are capable of being inflated, for the purpose described, until they are fully as large as a good sized orange, to which indeed they bear a strong resemblance both in shape and color. At all other periods of the year this skin shrinks up and is concealed by the feathers, so as to be nearly imperceptible. This singular arrangement is only found on the American grouse, and even of these but three or four species possess it.

The cock-of-the-plains is at present but little known excepting to those who have made ornithology their study, as it is only found in the far west, a great

distance from the abode of man, and consequently, except by the natives, it is obtained only by the exploring expeditions sent across the plains by government, or else by the solitary hunter and trapper, who, for a brief season, may have pitched his camp in their vicinity.

It is quite a large bird, the male frequently weighing five or six pounds; but, from the cause stated above, its flesh is not palatable, and consequently it will never, probably, be esteemed as an article of food. Yet it is a noble bird, which any country may be proud to possess, and let us hope that, as the districts near which it dwells become settled and cultivated, it may be protected by enforced laws from meeting the fate that has already overtaken some of its relatives in other portions of our country.

The general color of the cock-of-the-plains is light brown, each feather mottled and irregularly crossed with black and dark brown, and having also three bars of yellowish white, one near the tip, the others higher up, equidistant from each other. This marking extends throughout the upper tail coverts, and includes the two centre tail feathers. The tail, differing in shape from that of every other species of grouse, contains twenty long, sharp-pointed feathers, and is of a dark brown color, crossed with yellowish white lines. The wings are lighter than the back, and are conspicuous from having the shafts white. The throat and under part of the neck are black, interspersed with white lines and spots; a white band crosses the lower part of the neck and extends over the sides, covering the position of the gular sacks. The feathers on this portion, especially those on the sides, are very rigid, overlapping each other like scales, and, in some dried specimens, crackle like parchment when the hand is passed over them. The entire under parts are black, the under tail coverts tipped with white. The feathers on the legs are light brown, mottled with a darker brown. The bill, which is thick and strong, is black.

The female resembles the male, but is smaller and without the gular sacks. The black of the lower parts is not so extensive, neither are the stiffened shafts of the neck feathers so conspicuous, while the mottling of the upper parts is much greater.

The next species of this family to be considered, familiar to every one who has visited this continent, is the

RUFFED GROUSE, (*Bonasa umbellus,*)

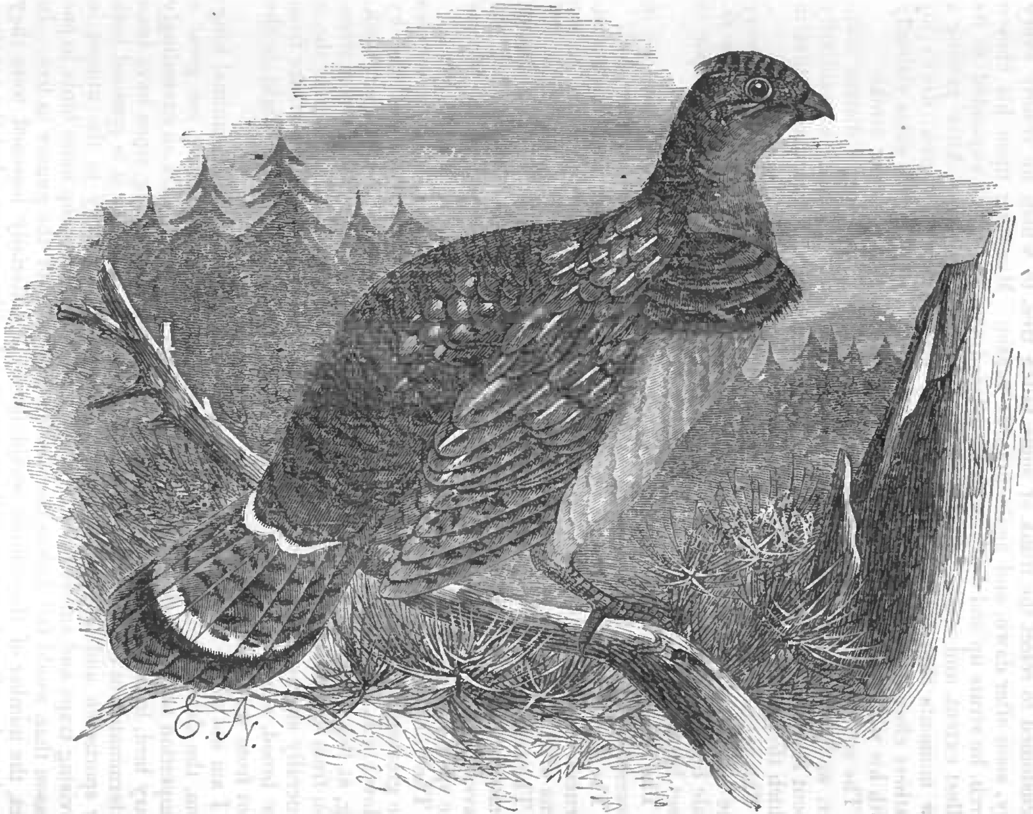
known in various localities, respectively, by the names of partridge and pheasant. This fine species, in the opinion of very many, surpasses, as an article of food, every other game bird.

I may remark here, that neither of the popular names given above, and by one or other of which it is commonly called, are at all appropriate, for it is a true grouse, entirely separate and distinct from both the forms with which it is confounded; and it is, moreover, very inaccurate to style it a pheasant, since, as I have previously remarked, there is not a single bird entitled to that appellation within the limits of North America. Ruffed grouse is its proper name, and it should be called by no other.

Peculiarly graceful in its movements, walking with a proud, firm step, erecting its head, and opening its beautiful tail with a sudden, quick jerk, it is seen to great advantage upon the ground, where indeed it passes the greater portion of its time.

I have often seen the female, when the young were but a few days old, on finding herself observed, instead of seeking safety in immediate flight, give a soft warning cluck, which caused the chicks to hide themselves rapidly, and then poise her body on one foot for a moment, eyeing me intently all the while, before walking slowly and proudly away until hidden by some intervening bush, when the loud whirring of her powerful wings announced her sudden flight.

Plate XLIII.



RUFFED GROUSE.

The most peculiar habit of the ruffed grouse is that of drumming, which is usually practiced in the spring, although I have heard the strange sound produced, while the bird is thus employed, during the summer and fall, sometimes as late as the month of November.

When the breeding season commences, generally early in April, the male is accustomed to select the trunk of some fallen tree, to which he resorts every day, soon after dawn, and again towards sunset. Mounting upon his chosen perch, he struts up and down, with his head drawn back, tail expanded to its fullest extent, and wings lowered until they touch the log. After passing a few moments thus employed, he suddenly stretches out his neck, draws his feathers close to his body, lowers his tail, and begins to beat his sides violently with his wings, increasing the rapidity of the movement at every stroke.

The sound produced by this motion is not unlike the rolling of distant thunder, and may be heard for a considerable distance. There is a peculiarity about it, also, for it often appears to come from a different direction to that in which the bird really is.

This is the drumming of the ruffed grouse, and it must be familiar to every one who has passed any portion of his time in the woods. As soon as the female hears the sound made on such occasions she flies directly to the spot to meet her mate.

The same log is chosen by the same bird, for this purpose, many seasons in succession, never, I believe, resorting to another unless frequently disturbed.

The males are polygamous, and desert the females when incubation commences, associating by themselves in small parties, and do not return to the hens until late in the autumn, when young and old go together.

The nest generally contains ten to twelve eggs, yellowish in color, spotted sometimes with dull red, and are rarely covered over by the female when she leaves them, as is customary with the turkey, so that they frequently become the spoil of some hungry crow, always on the look-out for such dainties.

The young follow their mother when they are but a day old, and she evinces the greatest affection for them, covering them with her wings at night, and, by a low cluck, warning them to hide at the slightest appearance of danger; seeking, at the same time, by feigning lameness or inability to fly, to distract attention from her offspring and cause pursuit to be made after her. In this she is generally successful, and when her enemy has been led to a safe distance from her brood, she suddenly takes wing, and returns by a circuitous flight to the spot from which she was disturbed.

I am not aware that the ruffed grouse has a single friend in the animal kingdom, the delicacy of its flesh at all seasons of the year proving too great a temptation to be withstood; and were it not that it is at all times an exceedingly wary bird, inhabiting places difficult of access, it would long since have been exterminated in nearly every portion of our eastern coast, for it is pursued both by sportsmen and also by others, who tax their ingenuity to the utmost in devising traps and snares to catch them, these last destroying more birds in one season than would fall before the well-directed shot of the gunner in five. In fact, the number of these birds would never be materially lessened were they sought only, after they were full grown, in a legitimate way; but the practice, which cannot be too severely condemned and punished, of slaughtering the young, even before they are old enough to be independent of their mothers' care, in order to gratify an epicurean taste, will soon cause this pride of our forest game birds to disappear from our midst, and when it is too late we shall begin to awake to the necessity of devising means for their protection.

Late in the winter, if the snow has been deep or of long continuance, these birds feed upon the leaves of the *Kalmia latifolia*, or common laurel, and then their flesh becomes very bitter and disagreeable; sometimes, indeed, it is dangerous to eat them, and instances are known to me when the flesh of this grouse

at this season has been nearly fatal to those partaking of it, and would undoubtedly have been so had not medical aid been near at hand. Their usual food consists of seeds, berries, grapes, &c., and when all these become scarce, they subsist upon the leaves of the evergreens. They roost in trees, choosing where the foliage is most dense, generally taking up their positions at a little distance from each other.

When suddenly startled by a dog or other animal, they immediately take refuge in the nearest tree, standing upright close to the trunk, and remain so still and motionless that it requires a practiced eye to perceive them. They will continue in this position until they perceive they are observed, at which they are very quick, when they immediately fly away to some other refuge. This bird rises from the ground with a prodigious whirring of the wings, and flies generally in a straight line, although, as every sportsman is aware, it is capable of making very sudden and sharp turns, and usually does not go any very great distance before alighting.

This species may be described as follows: head and back part of the neck yellowish red; deep chestnut upon the back, interspersed with white spots margined with black; tail reddish yellow, barred and mottled with black, with a broad subterminal band of the latter color. A yellowish white band runs through the eye; the throat and lower part of the neck brownish yellow. Feathers of the ruff, always most conspicuous in the male, are velvet black with blue reflections; under parts white with large spots of brownish red; under tail coverts mottled with the same; bill, horn color, black at the tip.

A great difference is observable in specimens of this species, some being of a greyish hue, particularly on the tail feathers, which often have no trace of red whatever. This I do not consider as indicating that there are two species, but merely variations from the typical form, as it is frequently the case that eggs in the same nest produce both styles of coloring.

A variety of this bird, known as

SABINE'S GROUSE, (*Bonasa Sabinei,*)

is found on the west side of the Rocky mountains, and is considered at present as a different species, the prevailing hue of which is a very deep red. In its habits it resembles its relative of the eastern portion of the continent, and is, I believe, no way inferior as an article of food.

Intermediate with these, and called by ornithologists the

ALLIED GROUSE, (*Bonasa umbelloides,*)

is a third species, this also inhabiting the Rocky mountains and northward to the frozen regions. It is of a very light gray color, and much smaller than either of the preceding, and can also be distinguished by a difference in the markings of the plumage.

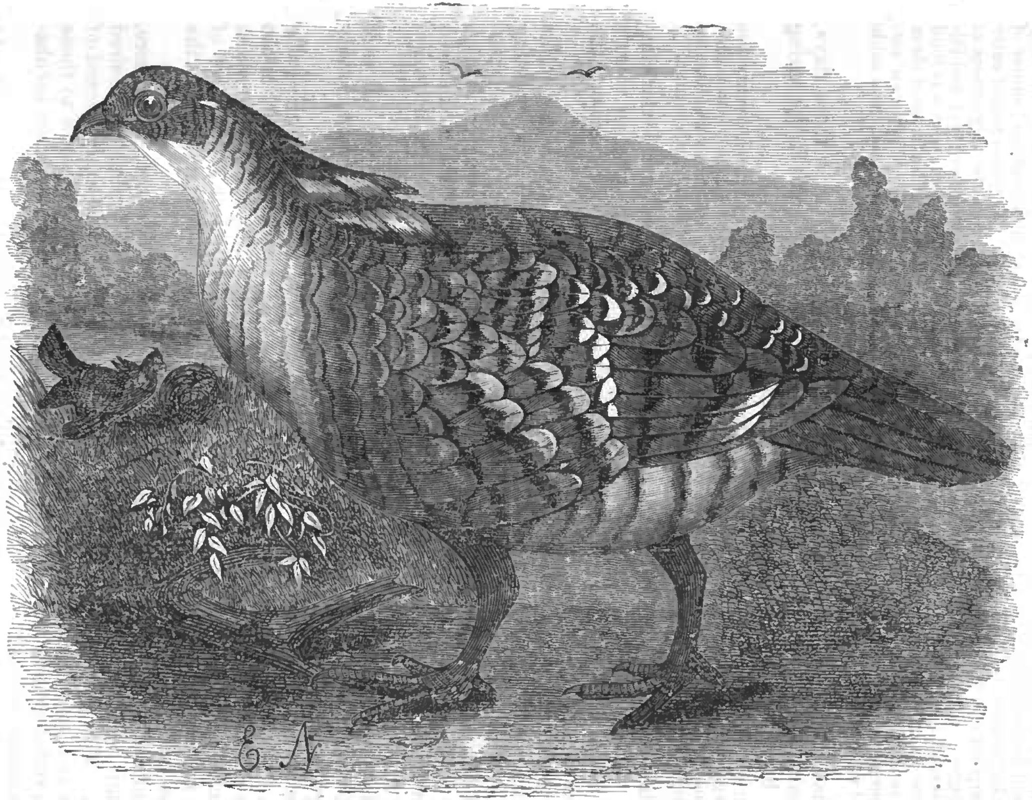
Up to the present time these are all the species known as ruffed grouse that inhabit America; and it is very probable that all have now been discovered, as the explorations made within the past few years have been very thorough and complete in this branch of science, rendering it very unlikely that so large a bird as a grouse would escape detection.

The next species is an exceedingly valuable one, considered as an article of food, and equally well known as the last. It is the

PRAIRIE HEN, (*Cupidonia cupido,*)

or, more properly, pinnated grouse. Formerly this fine bird was distributed in great numbers from the Atlantic coast to the Mississippi river; but now, save

PLATE XLIV.



PINNATED GROUSE.

in one or two places, it has entirely disappeared from the eastern shore, and to meet with it in any numbers one must go as far westward as Illinois, where, indeed, each succeeding year witnesses its gradual diminution.

Hear what Audubon says:

"When I first removed to Kentucky the pinnated grouse were so abundant that they were held in no higher estimation as food than the most common flesh, and no 'hunter of Kentucky' deigned to shoot them. In those days during the winter the grouse would enter the farm-yard and feed with the poultry, alight on the houses, or walk in the very streets of the villages. I recollect having caught some in a stable at Henderson, where they had followed some wild turkeys. In the course of the same winter a friend of mine, who was fond of practicing rifle shooting, killed upwards of forty in one morning, but picked none of them up, so satiated with grouse was he, as well as every member of his family. My own servants preferred the fattest flitch of bacon to their flesh, and not unfrequently laid them aside as unfit for cooking."

What numbers of this splendid bird must there have been in those days, enlivening the scene and disturbing the air with their love-notes in the spring time; but how is it now? I still quote from the same author:

"Such an account may appear strange; but in that same country where, twenty-five years ago, they could not have been sold at more than one cent a piece, scarcely one is now to be found. The grouse have abandoned the State of Kentucky, and removed (like the Indians) every season further to the westward, to escape from the murderous white man."

Think of it—twenty-five years all the time required for their extermination! If, when so abundant, they could be made to disappear in so short a time, how long will it be before, in their now greatly diminished numbers, the last pinnated grouse will have vanished from off the face of the earth?

In the early spring, at break of day, the prairies of the west, where these birds are still found, resound with the loud *tooling* of the excited males, who meeting together as though by appointment, with their feathers ruffled, strut in the manner of the turkey-cock up and down the chosen arena, eyeing each other with angry looks, their gular sacks extended, and the long feathers of the neck raised up, until their pugnacious feelings overcoming every other, they fight furiously; rising in the air and striking at each other, or joining in a closer strife.

This encounter is persevered in until the weaker birds give way and seek refuge in the neighbouring bushes, when the conquerors, with, perhaps, hardly strength enough left for the effort, strut off in search of the hens.

The *tooling* of the pinnated grouse is made by exhausting the air in the gular sacks, in the same manner employed by the cock-of-the-plains, described in the article on that species, and consists of three notes uttered in quick succession, producing a muffled sound, which may be heard in the clear atmosphere of those regions nearly half a mile. This noise is made by the males only, the females being destitute of the necessary apparatus.

Should these air-sacks become punctured the bird is unable to tool any more, although he will go through all the motions requisite to accomplish the desired result. The nest, placed upon the open prairie, is very carelessly formed of leaves and grass, and generally contains twelve eggs, similar in color to those of the ruffed grouse, and the young appear in about three weeks after incubation is commenced.

But one brood is raised in a season, although, if from mishap the eggs should be destroyed, the female will lay again. Unlike the ruffed grouse, which is of an untamable disposition, the prairie hen is easily domesticated, and will breed in confinement, thus rendering their preservation from extinction a comparatively easy matter.

These birds generally roost upon the ground, within a short distance of each other, so as to be able to rise upon the wing at the slightest warning without coming in contact. The habit of roosting in this manner is frequently taken advantage of by some unscrupulous person, who procures a net, and going after dark to the place, which he had previously ascertained was frequented by the

birds, generally succeeds in securing the larger part of the flock at one haul; the survivors of this barbarous attack immediately desert the locality, however, for some other less dangerous to them.

When walking upon the ground the pinnated grouse assumes a very erect attitude, and bears itself with much dignity, but, nevertheless, is wanting in the graceful elegance of carriage which characterizes the ruffed grouse. If startled it runs with great speed until it either takes wing, or else satisfied that it has arrived in a place of security, it squats close to the earth, and remains motionless until flushed.

In the middle of the day they are fond of dusting themselves in the roads or ploughed fields, in order to cleanse their feathers from insects, or any substance that may cling to them. Their flight is strong, well sustained, and rapid, propelling themselves by several beats, repeated in quick succession, and then sail onward for some distance, with the wings slightly bent downwards, when the beats are again repeated.

In August and September, before the broods are fully grown, they will lie well to a dog, and great numbers are then shot by the sportsman; but later in the fall they "pack," that is, many families join together, to the number sometimes of several hundreds, and are then wild and difficult of approach, rising out of gun-shot and continuing their flight often for over a mile. If followed and started again, they frequently scatter on alighting, and will then lie close, enabling the gunner to obtain many of them.

At this period of the year, during the middle of the day, they frequent the corn-fields and pick up the grain which may have fallen to the ground, returning to the prairie, at evening, to roost. When they are among the corn it is very difficult to kill them, as a person makes so much noise passing between the stalks that the birds become alarmed and take to flight, frequently unobserved. Much time have I passed toiling after them in these unfavorable places, and considered myself fortunate if five or six birds were the result of my labor.

The pinnated grouse is capable of going a considerable time without water, the districts which they inhabit being generally dry; and, like other members of this family, they quench their thirst by picking off the drops of dew or rain glistening upon the grass.

In the winter they are fond of perching upon the fences, and early in the morning the topmost rails, for a long distance, are hidden by the multitude of these grouse which have settled on them.

They desert their perches as soon as the sun is two or three hours high to seek their daily food. Often they may be observed alighting on the trees, along the larger branches of which they walk with ease, and sometimes they also roost on them; but, as before remarked, their favorite place for this purpose is the ground.

The two sexes resemble each other in the color of their plumage, the principal difference being, that the male possesses the gular sacks, and tufts of lengthened feathers on the sides of the neck. They may be described as follows: General color of the upper parts brown, transversely barred with blackish brown, the tail feathers purplish brown, the two middle ones lighter and mottled with brownish black. The under parts are white, marked with broad curved bands, arranged in regular series, of a grayish brown; the under tail coverts crossed with brown and margined with black. A membrane over the eye, and bladder on the neck, orange yellow. Bill dusky, feet dull yellow. Feathers on the legs gray, minutely banded with yellowish brown.

To the westward of the Mississippi river, upon the vast plains which stretch away to the Rocky mountains, a closely allied species is found, replacing the subject of the previous article. It is known as the

SHARP-TAIL GROUSE, (*Pediocaetes Columbianus,*)

and in its habits closely resembles the prairie hen, although it is destitute of the air-sacks, so prominent in the other during the spring. Its flesh is like that of the pinnated grouse—indeed, it is impossible to distinguish them apart when served up together.

The sharp-tail grouse is never found upon the highlands or in the forests, its natural home being the prairie, where it congregates in flocks, and frequents the patches of wild rye, and when near the settlements, the wheat stubbles, in search of the scattered grain.

Like its relative, it perches on cold mornings upon the fences, or leafless branches of the trees, to bask in the early sunlight. When taking flight it utters a clucking sound, often repeated, and proceeds rather swiftly, usually in a straight line.

The present species has the head and throat brownish yellow, the former irregularly marked with black or very dark brown; the back is ferruginous brown, variously spotted with black and brownish gray, with large white spots on the wing coverts. The tail feathers have the inner web white, outer grayish; the central ones elongated and same color as the back; under parts pure white, with a brown U-shaped mark on the breast and flanks. Bill black, feet brown. There is no difference between the sexes in color of plumage.

Hybrids, between this bird and pinnated grouse, are often obtained, and sometimes between it and its northern relative. The offspring of the first two are generally very handsome birds, possessing much of the pure white under parts of the present species, and having the upper part of the breast and flanks crossed with bars scalloped on the lower edge, instead of the single heart-shaped spot, making a very peculiar effect. They vary in their markings accordingly as one or other of the species predominates in the individual.

A second species of this genus is the

ARCTIC SHARP-TAIL GROUSE, (*Pediocaetes phasianellus.*)

This bird is a native of the far north, never coming within the limits of the United States. It is about the same size as the common species, but of a much darker color, being black where the other is brown.

Hearne is the only writer who has given any detailed account of this bird. He says that—

"When full grown and in good condition they frequently weigh two pounds; and though the flesh is dark, yet it is juicy, and always esteemed good eating, particularly when larded and roasted. In summer they feed on berries, and in winter on the tops of the dwarf birch and the buds of the poplars.

"In the fall they are tolerably tame, but in the severe cold more shy, frequently perch on the tops of the highest poplars, out of moderate gunshot, and will not suffer a man to approach.

"They sometimes, when disturbed in this situation, dive into the snow, but the sportsman is equally balked in his expectation, as they force their way so fast under it as to raise flight many yards distant from the place they entered, and very frequently in a different direction to that from which the sportsman expects.

"They, like the other species of grouse, make their nest upon the ground, and lay from ten to thirteen eggs."

The two closely allied species which come next on our list are inhabitants of the Rocky mountains, and thence westward to the Pacific coast.

The one I shall take up first is the

DUSKY GROUSE, (*Dendragapus obscurus,*)

a magnificent bird, exceeding in size any of the preceding species, excepting the cock-of-the-plains, and, like the ruffed grouse, has the flesh white. It is popularly known in those distant regions by the name of dusky, blue, or pine grouse,

and the male is furnished with the curious air-sacks on his neck, by means of which he utters his love-note.

In November this bird is generally missed from his accustomed haunts, and will not be met with, excepting in a few instances, until the following spring. This strange fact has given rise to the belief among the settlers that it passes the winter in a state of torpidity amid the thick foliage of the evergreens; and some assert that any one possessing good eyesight could discern them any day at this period by carefully looking for them in the tops of the loftiest firs.

But, as this is contrary to the habits of all birds, the far more probable supposition is that they are partially migratory, and either descend to the milder temperature of the valleys, or else proceed, to a limited extent, southward.

This bird passes much of its time upon the ground, where it will lie very close, starting up when disturbed from almost under one's feet, and, instead of seeking safety in flight, will take refuge in the nearest tree, where, standing erect upon the branches, it remains as motionless as the limbs themselves, rendering it very difficult to discern them.

They nest upon the ground, and the eggs are of an ash-brown color. They are said to be a very fine table-bird, sometimes the dash of *pine* taste its flesh possesses only adding to its game flavor. Their weight is generally between two and three pounds, although some males have been found weighing three pounds and a half.

By the first of August the young are half grown, and then are easily killed. At this time they are much sought for on account of the delicacy and tenderness of their flesh.

The male exceeds the female in size, and is one of the very finest birds among the American grouse. Its distribution appears to be northern California, the Columbia river, as far as the coast of Oregon and Washington Territories, and southward, in the main chain of the Rocky mountains, as far as Texas.

A description of the male would be as follows: Entire upper parts leaden gray, each feather mottled with rufous brown and black, this color extending throughout the upper tail coverts, the two central feathers of which are tipped with ash. The wings are bluish gray, mottled like the back, with the large quills brown; throat white, irregularly crossed with black; breast and abdomen dark lead color, the feathers on the flanks broadly marked with white; a spot of white upon the neck, just forward of the wing, which covers the naked skin of the gular-sack when not inflated; the tail feathers are black, rounded at the end, with a broad terminal band of ash gray, and the under coverts dark lead color, broadly tipped with white; thighs pale brown; bill black.

The female is very differently marked, and has the upper parts a grayish brown, each feather barred with black and reddish brown; upon the neck these bars are brownish yellow; upper part of head yellowish brown, crossed with fine dark brown lines; back of neck leaden gray, indistinctly barred with black lines; upper tail coverts grayish, with zigzag lines of black and yellowish brown; wings lighter brown than the back; throat white, faintly marked with brown; under parts lead color, lighter than the male; the feathers bordering the abdomen broadly tipped with white; tail black, with a terminal band of ash gray, the two central feathers mottled like the back.

The second species of this genus, called

RICHARDSON'S GROUSE, (*Dendragapus Richardsonii,*)

has, until quite lately, been confounded with and esteemed the same as the previous species, but it can easily be distinguished by the shape of the tail, which is *square* at the tip and uniformly black to the end, and never seen with the broad band of ash so conspicuous upon that of the dusky grouse. There

are also other differences not necessary to enumerate here, while the female also varies from that of the other species.

The account given of its ally will answer for this species also, as inhabiting similar districts, their habits being chiefly the same.

Richardson's grouse is found from the South Pass of the Rocky mountains northward throughout the range, and also on the slopes as far as the forests extend, and has never been observed on the plains.

Our list of the grouse will be completed with the two following species, the first long known to the inhabitants of the more eastern States as the

SPRUCE GROUSE, (*Canace Canadensis.*)

Distributed throughout the northern United States, and thence to the Arctic sea, and westward nearly to the Rocky mountains, it makes its home amid the deep recesses of the thick forests and swamps, where man can with difficulty pass. It is a gentle, unsuspicious bird, and, unlike other members of this family, does not exhibit much fear of man's presence. Easily tamed, it bears confinement well, and will feed readily upon oats, wheat, and other kinds of grain.

The breeding season commences within the limits of the Union about the middle of May, but further northward nearly a month later. The female conceals her nest, composed generally of leaves and moss, under the drooping branches of the fir-trees, and lays ten to fifteen deep buff-colored eggs, spotted with brown. When incubation begins the males go apart by themselves to different portions of the forest, and remain until late in autumn, when they rejoin the females and young. When thus separated they are more shy and wary than at any other period.

As an article of food the flesh of this grouse is not particularly inviting, being often so bitter as to render it unfit to eat; but it is more palatable when the bird has fed solely on berries.

When the spruce grouse is startled it usually flies but a short distance, and takes refuge in some thick spruce tree, where it will remain motionless, watching its pursuer; and if one's eyes are sufficiently keen to observe its location, it is easily shot from its perch.

The males strut before the females in the spring in the manner of the other species of grouse, and frequently rise several feet in the air, beating their sides with their wings, producing a sound similar to that made by the ruffed grouse when, upon his log, he calls the hens, as described previously.

But one brood is raised during the season, and the young follow their parent as soon as they are hatched. The breeding places are generally in the most secluded portions of the woods, where the moss covers the ground with its green mantle, into which a man would disappear did he venture to cross, thus affording a sure protection to the "light-footed grouse." They rarely appear on the open ground, confining themselves to their much-loved woods, and are not often, on this account, obtained in any numbers.

The male has the upper parts plumbeous gray, each feather crossed with black bars; wings and flanks brownish, mottled with black; upper tail coverts mottled with black and tipped with gray; throat and band on the breast black, the former bordered with white; under parts white, irregularly crossed with black; tail dark brown, with a broad margin of chestnut; the under coverts black, barred, and tipped with white; bill black; legs covered with yellowish brown feathers; feet brown.

The female is much lighter than the male; upper parts similarly marked with black, but mixed with orange; flanks, sides of the neck and wings brownish orange crossed with black, the feathers on the wings having a central white streak; throat yellowish white; centre of abdomen white, barred with black; tail dark brown, crossed with five or six rows of orange, and with a broad ter-

minal band of the same; bill blackish brown; feathers of the legs yellowish brown; a membrane over the eyes of both sexes of a vermilion color, most conspicuous in the spring.

The second species, called

FRANKLIN'S GROUSE, (*Canace Franklinii,*)

but lately brought to the knowledge of ornithologists, from its retreats amid the Rocky mountains, in its habits closely resembles the preceding, but is a mountain bird, and does not frequent the swamps to the same extent.

Douglass, who first discovered it and noticed its variations from the spruce grouse, says:

"That its flight is similar to that of the ruffed grouse, and that it runs over the rocks and among the brushwood with amazing speed, and only uses its wings as a last resort to escape. Nests on the ground, not unfrequently at the foot of decayed stumps, or by the side of fallen timber in the mountain woods. Eggs, five to seven, dingy white."

He continues:

"I have never heard the voice of this bird, except its alarmed note, which is two or three hollow sounds, ending in a yearning, disagreeable, grating noise, like the lower part of the call of the well-known *Numeda Meleagris*, (Guinea hen.) It is one of the commonest birds in the valley of the Rocky mountains from latitude 50° to 54°, near the source of the Columbia river. Sparingly seen in small troops on the high mountains which form the base or platform of the snowy peaks, 'Mount Hood,' 'Mount St. Helen,' and 'Mount Baker,' situated on the western part of the continent."

The principal difference between the males of these two species in the color of their plumage is, that the present has the tail uniformly black to its tip, and the upper and under coverts broadly tipped with white, while the shape is *square,* not rounded. The form of the markings on the flanks is different also.

The female may be distinguished from that of its relative by being of a much richer brown upon the breast, and in having the upper and under tail coverts tipped with white, as also the tail feathers themselves.

Here our list of the grouse, strictly speaking, terminates, all of those enumerated being valuable birds, as regards both their fitness as food for man and as ornaments to our country. There is a genus, however, belonging to this family whose members are of great importance to those among whom they dwell, as they constitute one of their main reliances for subsistence during the long and trying winters of the frozen regions. These birds are the ptarmigan, sometimes called snow grouse, only one species of which dwells within the limits of the Union. They are natives of the far north, admirably adapted by nature to withstand the piercing air and intense cold of those desolate steppes. They all turn white in winter, but in summer are beautifully mottled with various colors. From the grouse, beside the fact just mentioned, they differ, in having the feet completely feathered, thus leaving no portion of them exposed save the bill and the nails,

The only species found in the United States is the

WHITE-TAIL PTARMIGAN, (*Lagopus leucurus,*)

a native of the Rocky mountains, and, like all of this genus, it prefers the temperature of eternal snow, and descends from its loved heights only for the purpose of incubation, returning as soon as that duty is accomplished.

The change of plumage is an additional protection, for in their winter dress of pure white they are so assimilated to the color of the snow that they are invisible even to the searching eyes of their enemies, while in summer their plumage closely resembles the lichen and the moss.

A better known species is the

WILLOW PTARMIGAN, (*Lagopus albus*,)

which sometimes, in severe winters, approaches the northern border of the United States, its abode being the vast district of country lying between the States and the Arctic sea. They are found at times in almost incredible numbers, and are captured in great quantities by the people among whom they live.

Hearne, speaking of them, says:

"They are by far the most numerous of any of the grouse species that are found in Hudson's bay, and in some places, when permitted to remain undisturbed for a considerable time, their number is frequently so great as almost to exceed credibility. I shall by no means exceed truth if I assert that I have seen upwards of four hundred in one flock near Churchill river; but the greatest number I ever saw was on the north side of Port Nelson river, when returning with a packet in March. At that time I saw thousands flying to the north, and the whole surface of the snow seemed to be in motion by those that were feeding on the tops of the short willows. Sir Thomas Button mentions that when he wintered in Port Nelson river, in 1612, his crew killed eighteen hundred dozen of these birds. In summer they eat berries and small herbage. Their food in winter being so dry and hard makes it necessary for them to swallow a considerable quantity of gravel to promote digestion; but the great depth of snow renders it very scarce during that season.

"The Indians, having considered this point, invented the method now in vogue among the English of catching them in nets by means of that simple allurement, a heap of gravel. The nets for this purpose are from eight to twelve feet square, and are stretched in a frame of wood, and are usually set on the ice of rivers, creeks, ponds and lakes, about one hundred yards from the willows, but in some situations not half that distance. Under the centre of the net a heap of snow is thrown up to the size of one or two bushels, and, when well packed, is covered with gravel.

"To set the nets when thus prepared requires no other trouble than lifting up one side of the frame and supporting it with two small props about four feet long; a line is fastened to these props, and the other end being conveyed to the neighboring willows, that a man can always get at it without being seen by the birds under the net.

"When everything is thus prepared, the hunters go into the adjacent willows and woods, and when they start the game, endeavor to drive it into the net, which at times is no hard task, as they frequently run before them like chickens; and sometimes require no driving, for, as soon as they see the black heap of gravel on the snow they fly straight toward it.

"The hunter then goes to the end of the line, and when he sees that there are as many about the gravel as the net can cover, or as many as are likely to go under at that time, with a sudden pull he hauls down the stakes and the net falls on the snow, and encloses the greater portion of the birds that are under it. By this simple contrivance I have known upwards of three hundred caught in one morning by three persons, and a much greater number might have been procured had it been thought necessary.

"It is common to get thirty to seventy at one haul, and in the winter of 1736 the master of a sloop at Churchill river actually caught two hundred and four at two hauls.

"They are by no means equally plentiful every year, for in some winters I have known them so scarce that it was impossible to catch them in nets, and all that could be procured with the gun would hardly afford one day's allowance per week to the men during the season.

"But in the winter of 1785 they were so plentiful near Churchill, and such numbers were brought to the factory that I gave upwards of two thousand to the hogs."

From the above interesting account it may easily be imagined how prolific these birds are, and also it is not surprising that they are not always so abundant when such means are resorted to in order to obtain them. Netting and snaring are more to be condemned than all the other means employed for the capture of game, and wherever it is generally practiced the disappearance of both birds and beasts will assuredly be the result.

The average number of eggs laid by this species is about ten, and the males, unlike other members of the family, remain in the vicinity of the nest during incubation, and accompany the female and her brood when that duty has been accomplished.

Their flight is regular and swift, and they utter a loud cluck, quickly repeated, on rising from the ground.

In the male the head and neck are bright chestnut, with the feathers on the crown of the head and back of the neck barred with black. The back, forepart of breast, and sides under the wings, of a darker chestnut than the neck, and mottled with black, dark brown, and white, somewhat resembling tortoise shell.

Greater portion of the wings, the middle of the breast, abdomen, legs, and feet pure white. Tail brownish black, tipped with white; bill black.

The female is smaller, and has the upper parts variegated like the male, but is lighter upon the breast, more of a yellowish color. Their usual weight is from one pound and a half to two pounds.

We have now reached, in our review of the game birds, a different family, that of the

PARTRIDGES, (*or Perdicidæ,*)

many species of which are found within the territory of the United States. They differ from the grouse in having their legs destitute of feathers and the nostrils uncovered.

The first of these which naturally presents itself to us for consideration is the

VIRGINIAN PARTRIDGE, (*Ortyx Virginianus,*)

generally called quail; a popular misnomer, however, for no species of true quail has yet been discovered in the New World. This bird is known by the above appellation throughout New England and some of the middle States; in Pennsylvania, and further south, by its rightful name of partridge.

Familiar to every one who has visited the country, the male, in the month of May, perched upon some fence, or low branch of a tree, utters his clear whistle, resembling the words *bob white,* sometimes *ah bob white.* This love-cry, for I suppose it may be so termed, as it is never or rarely heard at any other season, is emitted at short intervals throughout the day, and should the answering note of the female be heard, he leaves his chosen spot and flies to meet her. Should several males come together at this period, they fight obstinately until the stronger have driven the others away.

The female makes her nest of grass, circular in form, and places it at the foot of some tuft of grass, or amid the cornstalks, laying from ten to twenty pure white eggs, sharp at the smaller end. These are so nicely arranged within the nest, that should they be taken out it would be found impossible to return them as they previously were. The male often assists in hatching these, and always remains in the vicinity, cheering his mate by uttering his love-note from some favorite perch.

When the young are ready to leave the shell, a circular opening is made by the mother through which they are issued into the world. The shell that covers this spot remains unbroken, and is attached to the remaining portion by a small fragment which allows it to open and shut like a door upon its hinges; and a deserted partridge's nest, if it has escaped injury, is a curiosity well worth preserving, containing, as it would, a number of these shells, with their movable lids.

The young run as soon as they are hatched, and remain with their parents until the following spring, when they separate for the purpose of reproduction. They always roost at night upon the ground, arranged in the form of a circle, with their bodies nearly touching, and if alarmed, each individual takes a direct and separate course.

It would seem to be impossible to domesticate these birds, for though they may be hatched by the mother here, and brought up within the precincts of the barn-yard, yet they will usually, on the first opportunity, wander away to the fields and woods, and return to the wild life of their species. I am not aware that any efforts made for this purpose have ever been crowned with any signal success.

The food of the partridge consists of seeds, berries of various kinds, and in the autumn they frequent the wheat stubbles, and pick up the scattered grain.

Great numbers are destroyed every year, both by means of the gun and by snares

Although a hardy bird, yet it frequently succumbs to our severe winters, and multitudes of them are found frozen to death. When disturbed the whole flock rise at once, with a loud whirring of the wings, very trying to the nerves of the young sportsman, and fly with much rapidity, generally in a direct course, and after alighting scatter and lie very close, enabling their pursuer to flush them one at a time, and frequently in this way the entire covey is destroyed. As an article of food this bird is in much demand, being generally very plump, and its flesh white, tender, and juicy.

In some portions of the United States the partridge is partially migratory, and they cross rivers somewhat in the manner previously described of the wild turkey, and many, when attempting this feat, fall into the water and perish.

The male has the forehead, line over the eye, and throat white, sides of head and band below the throat black; the rest of the head and neck reddish brown; back and wings chestnut, lower portion of the former tinged with yellow; tail grayish blue, the middle feathers grayish yellow, mottled with black; sides of the neck spotted with white; under parts white, streaked on the sides with red, and transversely barred with black; under tail coverts red; bill black; feet grayish.

The female resembles the male, excepting the head, which has more reddish yellow, and also the throat is yellow instead of white.

An allied species, characterized as the

TEXAN PARTRIDGE, (*Ortyx Texensis,*)

is found in Texas. It is a smaller bird than our common species, but closely resembles it in plumage; a casual observer, indeed, would not detect much difference between them. I am not aware that they are very unlike in their habits, and the foregoing account will very likely answer for both.

The next, a very handsome species, and equally valuable as an article of food, is the

PLUMED PARTRIDGE, (*Oreortyx pictus,*)

a native of the mountain ranges of California and Oregon. It goes in rather small coveys, sometimes of not more than eight or ten, excepting from October to March, when, according to Douglas, it congregates in vast flocks, and seems to live in a state of almost perpetual warfare, and is found principally among the dense woods that border the Columbia river and its tributaries.

The male has the forepart of the body plumbeous, the upper parts yellowish brown, sometimes slightly shaded with red; the forehead is ash color, rest of head lead color; a crest of two long straight feathers springs from the centre of the head of a black color; the throat is bright chestnut, with a black margin, followed by a white band passing downwards from the eye; the middle of the breast is bright chestnut, the feathers on the flanks possessing margins of black and white bands succeeding each other; tail brown, the under coverts black, streaked with orange chestnut; bill black; feet yellow.

The female is similar, but less brightly colored. The feathers of the crest are much shorter, while the centre of the back, the wings, and tail are faintly crossed with dusky lines.

The next genus to be taken up contains two very handsome species, the first of which is the

CALIFORNIA PARTRIDGE, (*Lophortyx Californicus,*)

an inhabitant, as its name implies, of California, where it is found upon the plains and lowlands, sometimes assembling in flocks to the number of two or three hundred, and are generally fat and well flavored.

It takes the place there of our brave little bird of the eastern coast which is

never found so far to the westward. It appears to be confined to the plains, rarely or never, I believe, found in the mountainous districts, where it is replaced by the preceding species. I have had them in captivity, but like all of this family they were very restless, seeking all the time for some avenue of escape.

The male has the forehead straw color, behind which is a white band, which passes back along the sides of the crown, in the centre of which anteriorly is a narrow line of the same color; back of head light brown; crest velvet black, commencing in a fine point, increases in width towards the end, and curls forward sometimes over the bill; chin and throat black, with a white line coming from the eye; back and sides of neck blue gray, bordered with black, and a small spot of white at the end of each feather; rest of upper parts olive brown; tail gray; forepart of breast blue; abdomen buff, with a large chestnut spot in the centre, each feather margined with black in the form of a crescent; flanks brown, with a whitish line in the centre, and a broad one of buff on the outer webs; under tail coverts buff, with a central stripe of whitish.

Female wants the black and white markings of the head; has the throat brownish yellow, streaked with brown, and without the orange spot on the abdomen; the crest is short; bill black; feet gray.

The second species, equally distinguished for its beauty of plumage, is the

GAMBEL'S PARTRIDGE, (*Lophortyx Gambelii,*)

named in honor of its discoverer. It is an inhabitant of the upper Rio Grande and Gila rivers to the Colorado of California. The following account given by the then colonel, afterwards Major General McCall, is taken from Cassin's Birds of America:

"The habits of this species are in most respects similar to those of the California partridge, but it has always appeared to me less vigilant and wild. I was not so fortunate, however, as to discover its nest, nor did I gather from others any information as to its eggs, their color, or their markings. I frequently heard the call or song of the male bird during the period of nesting, which, from some cause or other not apparent to me, was later than that of its congener. As early as June 4 I found covies of the young of the Californian partridge large enough to fly, say one-fourth grown, whilst all the birds of this species (and I saw many) as late as June 16 were still without their young. But the voice of the male, as I was about to remark, is at this season strikingly rich and full. A very good idea may be formed of this cry by slowly pronouncing in a low tone the syllables "Kaa-wale, kaa-wale." These notes, when uttered close at hand, are by no means loud, yet it is perfectly astonishing to what a distance they may be heard when the day is calm and still. There was to me something extremely plaintive in this simple love song, which I heard for the first time during a day of burning heat passed upon the desert.

"I had reached the well of Alamo Mucho before noon, and had halted to rest my jaded mules after their toilsome march. I had passed the hours of noon stretched upon the sand near the well; the thermometer in the best shade to be obtained indicating a temperature of 140° to 150°, (Fahrenheit,) and as the sun began to decline towards the horizon, the first wakeful sounds of animal life that greeted my ear was the soft "Kaa-wale, kaa-wale," of this beautiful bird. I turned towards a cluster of mesquite, at the distance of some two hundred yards from which the call seemed to come, but could discern no object in motion.

"This song was continued at short intervals for about an hour, when at last one of the birds came forth upon the sand, and was soon followed by its mate. They ran lightly over the sand and glided into the gulley, where they began to search for their evening meal. I followed with my gun and secured both, a male and female. Later in the season, when a covey is dispersed, the cry for assembling is "Qua-el, qua-el." The voice at all seasons bears much resemblance to that of the California partridge, having in its intonation no similarity to the whistle of the Virginia or common partridge.

"The crops of those killed at the Alamo, and thence to the Colorado, were filled with the leaves of the mesquite, which seemed to be their principal food, though in some were found remains of coleopterous insects. In some of those killed near the river I found the wild gooseberry."

In the male the forehead is white, each feather having a narrow line of black, with a transverse white band succeeding; top of head reddish chestnut, crest brownish black, throat black, margined with white; upper part of body

PLATE XLVI.

bluish ash, flanks chestnut, each feather having a longitudinal stripe of white; middle of the breast and abdomen white, with a large black spot on the latter; bill black; feet brown.

The female has the throat whitish, with the head plain ash color, without the conspicuous markings of the male, and also destitute of the black on the belly. The crest is short and of fewer feathers.

The next genus has but one species, not as handsome as the preceding, and is known as the

SCALY PARTRIDGE, (*Callipepla squamata.*)

This bird is also an inhabitant of the Rio Grande of Texas, and although not so beautiful in plumage as either of the two last species, yet is a very pretty bird. It is noted for its extreme swiftness in running, and depends as much upon this power for eluding pursuit as upon its wings, rarely using the latter even in open ground. It prefers the vicinity of water-courses, and is wild and exceedingly watchful, rarely approaching the settlements. This species is generally very plump, its flesh white and of a delicate flavor, and is much esteemed for food. It has a beautiful crest, which can be laid flat upon the head, although it is frequently spread out like a fan. The same author from whom I quoted in the preceding article gives the following account of this bird:

"The habits of this species are more like those of the common partridge than either of the others, (Massena, California, and Gambels.) I have shot these birds over a pointer dog, and at times found them lie sufficiently close to afford good sport; this, however, it must be admitted, was not often the case, and never unless the cover was remarkably good; for, in general, they are vigilant and wild, making their escape by running on the first approach of danger. In swiftness of foot none of the family can compete with them.

"When running they keep the body erect, and hold the head high, and in this attitude they seem fairly to skim over the surface of the ground. On such occasions the white plume is erected and spread out like a fan, or rather like an old-fashioned *chapeau de bras*, worn fore and aft; this gives them a trim, jaunty air, that is peculiarly pleasing and attractive.

"This species is found further to the south, on the Mexican side of the Rio Grande, than on our own, owing probably to the rugged character of the country there, for I never met with it anywhere in low grounds. The first appearance it makes in Texas is a little above Rhinosa, on the first highlands on this side encountered in ascending the river from its mouth. Thence up to the Rocky mountains the birds of this species may be considered denizens of the United States, being about equally distributed on both sides of the great river."

The head is light ash color, the crest broadly margined with white. General color bluish ash, growing paler on the under parts, and nearly white on the abdomen, with the feathers of the under parts edged with black; flanks have a central stripe of white on each feather, and frequently there is a large chestnut spot of a pale hue on the abdomen; under tail coverts almost white, striped with brown; bill black; feet brownish.

The sexes are nearly alike, the female, perhaps, not being quite so deeply colored, and the crest not so full.

The last member of this family to be included in this article is a very singular looking, yet beautiful bird, and is known as the

MASSENA PARTRIDGE, (*Cyrtonyx Massena.*)

The fantastic arrangement of opposing colors upon the head of the male creates a very curious and striking effect, so much so as to cause Mr. Gould, the eminent English ornithologist, to exclaim that it "forcibly reminds one of the painted face of the clown in a pantomime."

It is a native of Texas and Mexico, met with chiefly in the former territory, on the upper Rio Grande and the high plains of the Pecon. This species, I believe, generally goes in small covies, and is gentle and affectionate in its dis-

position, evincing but little fear of man's presence when he invades their domains, thus showing exactly the opposite trait of character from the scaly partridge, which is at all times wild and suspicious.

Captain S. G. French has given a valuable account of this bird, published in "Cassin's Birds of America," part of which I take the liberty of inserting here:

"It was in the summer of 1846, when crossing the then pathless and untrodden plains or table-lands which extend westwardly from San Antonio, Texas, to New Mexico, that I first met with this beautiful partridge. On a bright summer afternoon I undertook the ascent of a high rocky mountain for the purpose of obtaining a view of the valley through which the San Pedro river takes its course, and when I had gained the summit I observed several of these birds, a few feet only in advance of me, running along over the fragments of rocks and through the dwarf bushes, which grew wherever there was sufficient soil.

"Their handsome plumage and their gentleness attracted my attention, and I felt many regrets that I had left my gun behind me, thereby losing the opportunity for securing specimens for examination.

"They appear to inhabit the rocky sides of the mountains and hills in that desolate region of elevated plains west of the fertile portions of Texas, living amid the solitude that wraps them in silence, far from enemies and the busy haunts of men. In no instance have I met with this species near any settlements. The wild, rocky hill-sides in the lone wilderness seem to be their favorite resort, and there, where trees are almost unknown and vegetation is scant, and where hardly a living thing is seen, are these fine birds found in all their beauty and gentleness.

"The coveys of them showed but little alarm at our approach, and ran along over the rocks occasionally attempting to secrete themselves beneath them, in which case they would let a person approach within a few feet. When startled by the firing of a gun they fly but a few yards before again alighting, and exhibit little of that wildness peculiar to all the other species of partridges with which I am acquainted."

The male has the forepart and sides of the head white, with a black stripe beginning at the base of the bill, and running above and below the eye, the lower portion widening into a gular patch, which joins a broad black mark on the throat. A black line in the centre of the head, commencing at the bill, and changing to brownish on the upper part of the head. Crest buff yellow, upper parts light chestnut, every feather transversely barred with black, and having a central streak of yellowish white. The black bars are broader on the wings, sometimes forming nearly circular spots. A wide stripe of deep chestnut runs down the centre of the breast and abdomen; the flanks deep black, each feather with several circular spots of pure white; thighs and under tail coverts deep black. Tail and upper coverts same color as the wings. Bill dark brown, feet paler brown.

The female is very different. Head and upper parts of the body are reddish brown, each feather barred with black and streaked with yellowish white. Under parts cinnamon, with central stripes, and also one on each side the shaft, of black. The head is entirely without the conspicuous markings of the male. Throat is pale white, and the flanks have lines and small spots of black.

The foregoing species, belonging to the three different families, comprise all the game birds of the gallinaceous order inhabiting the United States; but there are two others not of this order which are justly considered as game, and which ought not to be omitted in an article devoted to that class of birds. They both are members of the family scolopacidæ or snipe, and the first to be considered is the well-known

WOODCOCK, (*Philohela minor.*)

This is a migratory species, not confined to any particular portion of the Union, but distributed throughout the country. The length of its stay in any part seems to depend entirely upon the weather, for though they may be, in some places, exceedingly abundant one day, yet should a severe frost occur during the night, the next morning their numbers would be very much diminished, or else the birds would have entirely disappeared.

The woodcock generally makes its appearance within our limits about the beginning of March, and remains until November; sometimes stragglers are found within the vicinity of warm springs, where the temperature of the water has prevented the snow and ice from remaining, even as late as the latter part of December. It migrates singly, and always at night. In fact, it is a nocturnal bird, roaming about chiefly after the sun has set, its sight seeming to be much better at night than in the bright light of the sun's rays.

It commences to breed in March in the northern States, but in the south fully a month earlier. Indeed, they often lay their eggs when the ground is still covered with snow to a considerable depth. The nest, which is formed of dry leaves and grass, without much care exhibited in its construction, is placed in a secluded part of the woods upon the ground. The average number of eggs is four, smooth, of a clay color, thickly spotted with dark brown. The young totter about as soon as they leave the shell, deserting the nest immediately, and are not fully fledged and able to fly until they are three or four weeks old. When first hatched they are very comical-looking little things, covered with a yellowish down, striped and marked with black or very dark brown, and with a bill to all appearance very much too long for them to manage.

Woodcock shooting is, probably, one of the most attractive of all those denominated as field sports, and immense numbers of these birds are annually killed, their destruction, I regret to add, commencing in very many instances before they are fully grown. Its flight is rapid, and as it is generally fond of dwelling where the foliage is dense, it requires a practiced hand always to bring it down. It does not often proceed in a straight course, but inclines to either side at every few yards, and if it has not been much disturbed will settle again after proceeding a short distance.

By many this species is considered as stupid, and I remember one instance which would seem to corroborate this opinion. I was once standing upon the piazza of a hotel in the country, when a woodcock flew by close to me, and it required no great dexterity for me to knock it down with my hand. On picking it up I found it was a full-grown bird, and could not account for its coming into such a locality unless the glare of the sun had dazzled its eyes so that it could not see its course distinctly. Many are the specimens I have seen which were killed by flying against the telegraph wire; but this is not so surprising, as the wire is not easily distinguished at any distance.

The woodcock is not addicted to wading, and always resorts to rivulets and margins of muddy ground, never seeking its food in salt marshes. It obtains this by probing the damp or moist earth with its long bill, and in this way procures the worms upon which it chiefly feeds, swallowing great numbers of them in the course of a night, as many, according to Audubon, as would equal its own weight.

In the fall this bird is generally found upon the hill-sides. I have met with them among oak trees, and amid evergreens, at some distance from any water. They obtain their subsistence, when in such localities, by turning over the dead leaves and picking up the worms which they may discover lying beneath.

The eye of the woodcock, which is large, bright, and very beautiful, is placed high upon the head; a very wise provision, for as the bird, when feeding, thrusts its bill into the ground up to the nostrils, the organ is protected from injury by coming in contact with the mire, and, at the same time, the bird is enabled to see its enemies some distance away while it is thus employed.

This species being highly esteemed as food, and considered a great delicacy, always commands a high price in our markets, which causes them to be eagerly sought for; yet, as it is a bird of passage, it would probably be saved from extermination, even in our thickly populated districts, were it sufficiently protected from molestation during the period of incubation, and while the young

were still not full grown; since not many are caught in snares, and it generally must be shot to be procured.

During the breeding season the woodcock has a curious way of ascending and descending in a kind of spiral flight every morning and evening, at the same time uttering a grating note. This sound is also often repeated when the bird is on the ground, and Audubon gives the following interesting account of it:

"On observing the woodcock when in the act of emitting these notes, you would imagine he exerted himself to the utmost to produce them; its head and bill being inclined towards the ground, and a strong forward movement of the body taking place at the moment the *kwank* reaches your ear. This over, the bird jerks its half-spread tail, then erects itself, and stands as if listening for a few moments, when, if the cry is not answered, it repeats it.

"I feel pretty confident that in spring the female, attracted by these sounds flies to the male; for, on several occasions, I observed the bird that had uttered the call immediately caress the one that had just arrived, and which I knew from its greater size to be a female. I am not, however, quite certain that this is always the case; for, on other occasions, I have seen a male fly off and alight near another, when they would immediately begin to fight, tugging and pushing each other with their bills in the most curious manner imaginable."

The woodcock may be described as follows:

Fore part of head grayish; upper part has two transverse bars of blackish, and two others of the same color, but narrower on the occiput; these last separated by light red; a line from the bill to the eye, and one below the eye, brownish black.

The entire upper parts are variegated with ash gray, rufous, yellowish, and black. Tail feathers brownish black, tipped with gray, and mottled with red on their outer edges. Entire under parts rufous, brighter on the sides and under the wings; under tail coverts tipped with white. Bill yellowish brown, darker towards the end. Feet flesh color.

The next species, though belonging to the same family, is of a different genus, and equally well known as the—

WILSON'S OR ENGLISH SNIPE, (*Gallinago Wilsonii.*)

It is distributed throughout our country, extending its migrations northward during the summer far beyond the limits of the United States. They go to the southern States, where they pass the winter, in the months of September and October, and return again in March and April, rarely halting to breed within the Union.

In Nova Scotia, where it frequently incubates, it begins to lay its eggs in June, choosing the swampy grounds as most suitable for the purpose, since there it is not liable to be disturbed, and also as it is in such spots that it is surrounded by an abundance of its favorite food.

The nest is a mere hollow in the m ss, and in this are deposited four eggs with their small ends down, olive in color, thickly spotted with light and dark brown.

The young are at first covered with down of a brownish tinge, and leave the nest as soon as hatched, feeding at first upon such small insects as they may find upon the surface of the mire, until their bills have received sufficient strength to enable them to probe deeper into the ground, at which operation they soon become very expert.

In the western part of the Union the English snipe arrives from its breeding ground in the north during the latter part of September, and immediately seeks the meadows, the banks of the rivers, and the borders of ponds. Often in such localities they are to be met with in great numbers, the ground seeming to be alive with them, as they rise when disturbed in flocks of from six to thirty or more.

When they take wing they utter a grating noise resembling *scaipe, scaipe,* and should the day be windy they will fly in an irregular zigzag course, very

trying to an inexperienced marksman, until they are nearly out of gunshot, when they proceed in a more direct manner. If they should be wild, as is almost always the case on rainy, boisterous days, at the report of a gun, dozens will rise in all directions, and many of them, after performing a very eccentric flight, sometimes high in the air, will pitch headlong with great velocity, frequently upon the same spot from which they arose, and soon disperse in search of food.

Snipe shooting is preferred by many to any other of our field sports, as it is always followed in open ground, no trees or bushes intervening between the marksman and his game, and the birds are among the most delicate of all those of our feathered game. But it also has its drawbacks, the principal one being, that it frequents swampy, treacherous ground, *through* which the sportsman is obliged to force his way, and it is no uncommon occurrence for him to sink nearly up to his waist in mud and water when striving to reach better ground, or to pick up some bird just killed. On warm, bright days the snipe will often lie with great pertinacity, and enable a good dog to point them, thus allowing a large number to be killed; but at other times it does not lie well, generally taking flight at a distance of twenty or thirty yards ahead of the dog.

The snipe walks easily and lightly, carrying its bill inclined downwards, and as soon as it finds a suitable spot thrusts several times in quick succession into the soft ground in search of its customary food. Having in this way exhausted one place, it seeks another, until its appetite being satisfied, it remains quiet until nightfall, when it flies about without fear of harm. The number of holes observed in the soil is an indication whether the snipe are plentiful or not in the locality, and their appearance readily indicates whether or not they have been recently made.

The food of this species is chiefly ground-worms, insects—sometimes a leech will not be passed unnoticed; and, according to some authors, it will eat the juicy, tender roots of different vegetables. Although the marshy grounds are its usual resort, I have, on different occasions, met with this bird in the fall upon the uplands, but never in any numbers. I suppose, when frequenting such situations they obtain their food in the same manner as does the woodcock, by turning over the dead leaves and seizing upon the insects which may be beneath.

Wilson, the poet-naturalist—pioneer of American ornithologists—was the first to observe the difference between this bird and the European species, (to which, indeed, it bears a close resemblance,) and therefore it is known to the scientific world bearing his honored name.

Great numbers of these birds are annually killed during their spring and fall migrations, and, as they are highly esteemed in our large cities, they are always in great demand. During the winter it is found often in large flocks on the wet grounds of Louisiana and other of the Gulf States, and the rice plantations of South Carolina are also a favorite resort.

In the spring, when mated, the two birds are accustomed to mount high in the air about sunrise, and sail around each other with great rapidity, producing a curious rolling sound, caused, probably, by the air passing swiftly through the feathers of their wings.

The snipe is rather a prettily-marked bird, having on the upper part of the head brownish black bands, separated by narrower ones of light brown, and another of the same color running from the bill over the eye. A loral band of dark brown, chin white, and neck reddish brown, spotted with very dark brown. Upper parts variegated with brownish black and reddish brown, the outer edges of the scapulars being yellowish white. Wings similarly mottled, outer edges of first primary white, some of the coverts also tipped with the same. Rump and upper tail coverts crossed with yellowish, brownish red and black bands. Tail feathers black, tipped with reddish, and with a subterminal black bar;

outer feathers frequently white and barred with black. Under parts white, barred on the abdomen, sides, and under tail coverts with brownish black. Bill brown, darkest at the end. Legs dark brown.

With this species the list of those which may be strictly considered as the land game birds of the United States terminates, but there is one other which, although not usually looked upon as game in its restricted sense, yet, because it is of considerable importance as an article of food, and possesses many curious and interesting facts connected with its habits, may not inappropriately be included in this article. I refer to the

WILD PIGEON, (*Ectopistes migratoria,*)

sometimes known as the passenger pigeon. This bird is remarkable for its symmetry of form, the extreme rapidity and elegance of its flight, as well as for the incredible numbers which at times pass over different portions of our land, affording, seemingly with but little diminution in their crowded ranks, food for hundreds, yes, thousands, of people.

It propels itself by quickly repeated flappings of the wings, bringing these at times closely to the body with firm strokes, and, before alighting, breaks the force of its flight by several rapid beats, as though fearing injury from coming too suddenly into contact with the object upon which it may desire to rest.

It is supposed to be capable of moving through the air at the rate of a mile a minute; and it has been killed in New York with its crop yet filled with the rice collected in the fields of Georgia and South Carolina, which it must have left only five or six hours before meeting its death. I say *only*, because, as they digest their food rapidly, they must necessarily have travelled the distance within the time allowed, in order to have arrived with the rice still in its perfect state.

The shape of their body is oval, with a sharp-pointed tail, admirably constructed for rapid evolutions, and also furnished with a pair of long wings, moved by large and powerful muscles. The rapidity with which this bird will pass through a wood is perfectly astonishing, threading its way amid the closely-grown branches with unerring course, it flashes upon the sight like a meteor, and is gone.

A pigeon-roost is a curiosity well worth a visit from any one who has the slightest fancy for the strange things in nature. No language can give a perfect idea of the appearance of one of these places, when occupied by its millions of tenants. Instances are known where these birds have covered the trees for a distance of forty to fifty miles in length by three to five in breadth, every limb of every tree within that spacious extent loaded and groaning with the weight of the numberless pigeons clustered on it. When approaching these roosts their advance is heralded by a sound like the gale when it sweeps over the ocean in uncontrolled fury, the sky is darkened by their inconceivable numbers, and the noise of their flapping wings, as they stay the rapidity of their course, is like the sound of many waters. They come by thousands in a flock, and settle on the trees around, while frequently the confusion reigning everywhere is increased by great limbs breaking from the weight of the birds upon them, and falling with a crash, carrying death and destruction among those which have alighted beneath. Some of these places are resorted to annually by the birds, and the farmers, just before the time the pigeons usually appear, will assemble for the purpose of obtaining them. Sometimes the hogs are driven to the roost to be fattened on the birds which are slain. Guns are used to kill them, but often long poles are equally effective, for the pigeons make little or no effort to escape. They continue to arrive often until the night has far advanced, and the uproar is continued until daybreak, when they begin to move off, and when the sun rises the majority have departed.

The flesh of the wild pigeon is dark, and by some is much liked. The young, or squabs, as they are termed, are very tender and delicate, and much more esteemed as food than the adult bird.

The pigeon generally selects the tallest and largest trees to breed in, and as many as fifty nests may be counted upon a single tree. The bearing of the male at this time is much like that of the domestic pigeon, elevating and depressing the body, swelling out the throat, and expanding the tail, he moves around the timorous female, uttering the soft *coo-coo-coo*, so familiar to everybody who has ever been near a dove-cot.

They lay only two eggs, elliptical in form, and of a pure white. When the young are about half grown, their enemies of every kind come to these places, and disturb the peaceful birds by endeavoring to get possession of them in all manner of ways. The quickest is to cut the trees down, and as one falls, by coming in contact with another, it shakes all the squabs out of the nests which may be on it, and soon the ground is covered with the little helpless things, and immense numbers are thus destroyed.

The wild pigeon never rests at any great distance from water, to which it resorts several times during the day, and when it drinks immerses its bill up to the eyes, and so remains until its thirst is satisfied.

Immense flocks of these birds, such as I have attempted to describe, are not so often seen now as formerly; the diminution of their number may be attributed equally to the destruction of our forests as to the birds themselves, and it is a rare thing in these days to witness, near the cultivated districts, any very great flight of pigeons. The skin is very tender and easily torn, while the feathers fall off at the least touch—characters peculiar to this family.

The male of this species has the throat, breast, and sides brownish red, sometimes with a purplish tint, rest of under parts bluish white. Head blue; hind part and sides of neck changing to gold, green, and bright crimson. Upper part of body blue; wing coverts marked with black spots; quills blackish, tipped with white. Inside tail feathers dark brown; rest blue on the outer web, white on the inner. Bill black; feet red.

The female has a similar distribution of colors, but very much duller than the male. Olivaceous above, beneath pale blue instead of red; a slight tinge on the neck, and the throat whitish.

With the consideration of the last species this article would naturally close, but it is eminently proper that I should discuss at this time several points relating to our game birds, and endeavor to bring them, as well as I may be able, to the notice and serious attention of all those who may read this review.

America, although possessing such an extensive and varied catalogue of birds, which, in many ways, are exceedingly valuable to her people, has done less to preserve them from actual extermination than, perhaps, any other nation. It is true that many of the State governments, through the praiseworthy exertions of enterprising individuals, have passed what are called "game laws;" but some avenue has always been found by those who have set them at defiance to escape from just punishment, and the originators of these laws have seen their laudable efforts for the preservation of the feathered tribes become virtually a dead letter.

One cause for this lamentable state of things is, that these laws have, almost always, been drawn up by those who live in our large cities, and passed through their influence, and are, consequently, looked upon with more or less distrust and suspicion by many farmers, who erroneously believe that the sportsman desires to prevent the birds from being killed, even by the owners of the soil, in order that, at certain seasons of the year, the country may be invaded by himself and friends sallying from the towns to gratify their own pleasure in the destruction of game, to the attempted exclusion of everybody else.

That such is the feeling in portions of our country is a well-established fact, known to all those who have ever gone out with dog and gun, and it is, more-

over, carried to such extent in some of the States that any man who may be seen equipped for sporting, traversing the fields, is peremptorily ordered off the land. This, however, is the undeniable right of every farmer, and, in many instances, instead of being a discourteous act, would be a matter of congratulation, as tending to further the wishes of those who had been instrumental in providing "game laws," were it not that the birds, in very many instances, are shot, trapped, and snared in and out of season by the country people themselves, in order to obtain the high price now offered in our markets for all our game birds.

Formerly these were unnoticed, and the farmer would wonder what the sportsman found to shoot, as, day after day, the report of his gun echoed through the woods and fields, and was surprised when the results of a day's work was exhibited; but when the extension of our railways into nearly every corner of the States gave a ready access to our markets, then every boy discovered that more could be earned in a day by strolling about with his gun than by working in the fields, and immediately there was commenced that crusade upon the feathered race which, with increasing perseverance, has been unintermittedly carried on to the present time to the utter extinction of many of our finest birds in some localities, and to their gradual diminution in every other place where they were found to exist. Lest this assertion may be doubted, or deemed an exaggeration, let me cite an instance to prove its truth.

The prairie-hen, or pinnated grouse, was once found in great numbers from the Atlantic coast to the Mississippi river, and was as abundant upon the plains of Long Island as it is now on the prairies of Minnesota and Iowa. But what can be said of it now? Long since has the last representative of this noble grouse disappeared from the eastern States, save in one or two isolated places, and the prairie-chicken has already become the subject of tradition, for but few persons are now living who can remember when it existed on our eastern shores.

That such extermination was unnecessary and wilful can be readily proved by the fact that, where adequate means have been employed for their preservation they still are found, if not in increased numbers, at least without any very serious diminution.

Upon the prairies of Ohio, Indiana, and Illinois, this bird once existed in countless multitudes; but what do we learn to-day from investigations carried on amid the apparently endless extent of those sky-bound plains? Simply that every year the pinnated grouse diminishes, and that if the proper means are not employed *now* to stop the universal destruction at work with this species, its disappearance from our country long before the close of the present century will be as certain as the inexorable decree of fate.

But some will say, "What is the use in preserving them; they are not very good eating?" Or else, taking another view of the case, will make the selfish remark that, "They will last my time;" and if you speak of the benefits to be conferred upon those who may come after us, will reply with the Irish baronet, "What do we care for posterity; what has posterity ever done for us?"

Yet, even to such individuals as these, something can be said in defence of our birds. Nothing was ever created in vain; each and every creature has its allotted duty to perform, and the most despised and persecuted feathered biped that ever flew accomplishes some good to man in the realm of nature.

The kindly offices of the birds are as necessary to the farmer as the welcome showers of the summer, or the genial rays of the life-inspiring sun, and although the opposite opinion is generally entertained, and a war without any quarter is waged on certain hated but little understood species, yet I do believe, if our birds should ever become seriously lessened in their numbers, that not a half crop of any cereal could be raised within the length and breadth of our wide domain.

Wild turkeys are denounced in unmeasured terms for their destructive propensities, and various are the ways employed, where they are numerous, to

extirpate them; and yet it is well known that a flock of the domestic bird will clear a field in a very short space of time of that fearful scourge to every land upon which it appears in numbers, the grasshopper; and other insects and hurtful grubs are alike destroyed by them.

That some species are injurious to the growing crops, in a measure, may be allowed; but no one can tell how much assistance those same birds may have been to the farmer, for it would be impossible to arrive at a just estimate of the number of insects which may have been consumed with the particles of grain. Yet this thought is forgotten, or never entertained at all, in the urgent desire to slay immediately the birds which may visit the fields.

Suppose we even grant that there are certain birds which it would be better for the crops if they had never existed; still, this admission could not be brought as an argument in favor of slaughtering the game birds, with which, at present, we have to do; for no one who has ever paid any attention to the subject will accuse them of occasioning any serious injury to our farmers.

Many of the species are inhabitants of the wilderness, of the swamps and lonely depths of the forests; yet they do not escape persecution any the more readily for this, and against them the warfare is as mercilessly carried as though each individual was guilty of the heinous offence of disposing of a bushel of corn every morning and evening.

It is not because they are destructive in their habits, although this may be, and is cited as a reason for the numbers destroyed, but on account of the demand *always* existing in the cities, and the extreme rates given for them, even when the birds are poor in flesh and unfit to eat; and it would seem that the more unseasonable they are, the greater is the demand, and the higher the price for them.

Lest some of my readers may imagine, because they see every day numbers of game birds exposed for sale, that they increase, instead of diminish, in the country, I will state a few facts to support my opinion that in a few years they will be found, many of them at least, no longer in the land.

The reason why so many are to be seen at once is, not that their numbers have become greater anywhere within the United States, but because the facilities for transporting them have increased, and now birds killed in Minnesota can be brought to New York perfectly fresh and fit for the table during the winter months, and, if packed in ice, in summer also.

Thus the entire country is made to contribute, and the results of this crusade are visible every day in our markets in the immense piles of game birds distributed on every side.

Now, to give a faint idea of the numbers thus destroyed: Statistics, particularly on this subject, are very difficult to obtain, and even when procured, are sometimes, not always, reliable, but the following facts may speak for themselves.

In this city, (New York,) *one* man has been known to receive, in one consignment, *twenty tons* of prairie chickens; allowing two pounds as the weight of each bird, a very fair average, the enormous number of twenty thousand pinnated grouse would remain, received by one person in a single day. The ruffed grouse, happily, cannot be captured in such flocks at once, but must be obtained one at a time, and yet I know of one firm that receive sometimes, on many Saturdays in succession, five hundred pairs of these birds.

Some of our large poultry dealers will sell in six months two hundred thousand game birds; others, one hundred and fifty thousand; and others, again, four hundred dozen, and so on downwards through the scale until the final result of all these amounts, if it could be accurately obtained, would make one stand aghast at the incredible numbers which are slaughtered every year; and the question would naturally occur, How long can any remain? while the close

of the present century would appear to be far too liberal an allowance of time within which the last game bird must disappear.

In the above estimates I do not include any waterfowl, but simply the ruffed and pinnated grouse, partridge, woodcock, and English snipe. Of all those enumerated in my list as game, these alone can generally be found for sale in our markets.

Wild turkeys sometimes occur, but never in any considerable numbers, and consequently are not included, while the other species are fortunately even yet too far removed to be transported without risk to the shipper.

These estimates, so far from being exaggerated, are probably far below the true state of affairs, and these, it must be recollected, are but the receipts of a single city; the total numbers of birds destroyed throughout the country would exceed the credibility of every one.

Now, with such facts as these before us, I would ask if it is not clearly the duty of those who take any interest in preserving to our country the valuable gifts which have been so liberally bestowed upon her, that all the influence and authority with which they may be possessed should be so directed as to cause this wholesale butchery of our game birds to cease?

The efforts of clubs and individuals have in a measure failed, as before stated, chiefly because they have been, at best, but feebly supported by the power of the respective States; and, if it were possible, it would indeed be a cause for rejoicing that the strong arm of the general government should be interposed for the preservation of the game birds before it is too late, and the hills and the valleys which for ages have been vocal with the love-songs of our noble birds in the gladsome spring-time have become silent for ever.

Do not think, reader, that this is a fancy-picture, a conception of the imagination only; it will become a stern reality, and Americans will present the sad spectacle of being the only civilized nation on the earth that did not esteem their game birds of sufficient importance to make one vigorous effort, while there was yet time, for their preservation.

This does not appear to me to be the proper place to make any suggestions in regard to the framing of suitable "game laws;" it is best to leave that duty to those whose legal acquirements render them more fitted for it; but I cannot refrain from entering my earnest protest against all kinds of snares and traps employed for the capture of game. They are perfect "besoms of destruction," sweeping clean, wherever they are used, the entire country of its winged game, and the practice should be discountenanced, and the offender visited with the severest punishment that the law would allow to be meted out to him. Destroy the snares and the birds will increase, for they can be but comparatively little diminished in their numbers when killed only in a legitimate way at the proper season; but I believe I am well within a safe limit when I say that fully one-half of all the game birds brought into our markets, excepting woodcock and snipe, are snared or trapped. In the western country, entire flocks of grouse and partridges are taken at one haul, in nets, and none left to propagate the species, and this fact alone is sufficient to account for their increasing scarcity year by year.

Portions of the past winter were unusually severe, and in Illinois (I speak from experience) the partridges, which last fall were found there in extraordinary numbers, were nearly all destroyed by the intense cold, so that now one may traverse acres without finding a single covey. Now, these few survivors, instead of being protected, so that the species may not become extinct, will, in all probability, be snared during the coming winter, and the partridge, in certain portions of the State, will have ceased to exist.

It has been said that the increase of population, the destruction of our forests, and the cultivation of the lands, tend to the disappearance of our game birds; and while with some species this may be partially the case, yet with

others these circumstances have exactly the opposite effect. For instance, the ruffed grouse and wild turkey are eminently birds of the wilderness, and undoubtedly would be affected as regards their numbers by the disappearance of the woods, yet there would always be sufficient remaining to afford cover and protection in settled districts even to these—certainly to the former; while, on the other hand, the partridge and woodcock are never seen in the virgin forest, but seek the vicinity of the settlements or cleared ground; and it is not until the settler's axe has levelled the woods around his dwelling, and admitted the warm rays of the sun upon the land, that these birds make their appearance. It is true that they both require woodland—in fact, the woodcock is never found where there are no trees; but it is not probable that American industry will ever extend its agriculture so greatly that no groves or coppices will remain to afford shelter to the feathered game. So we may take it for granted that the spread of civilization has the effect, not of exterminating the birds, but rather of increasing their numbers.

But there is one view to be taken of this subject, and I am glad to think that it is of importance to us as a people. Field sports have been, and ever will be, one of the chief reliances of a nation to save it from degenerating into effeminacy. Americans are probably more proficient in the use of fire-arms than any other nation on the face of the earth, and this has been brought about by the almost universal habit of our young men indulging in field sports, so that in the time of need, (has it not been well proved?) assisted by this most essential qualification, they have been enabled to defend their country from all her foes, and maintain themselves a free people. Let but the game of fur, fin, and feather become extinct in the land, and the rifle and the gun will be laid aside, and those who may come after us will be as utterly unused to handle these weapons with even safety to themselves as though such articles had never been known. The rifle, that deadly national weapon, through the disappearance of our larger game, has fallen entirely into disuse upon our eastern shore, and the shot-gun, which has followed it, will likewise be laid aside before long as unnecessary, unless the proper steps are taken, and laws passed and enforced, for the protection of our birds.

Many are the benefits conferred upon a people by having within their reach the power of indulging in the revivifying excitement of the chase. Does not one seem to receive a new lease of life as he walks through the wood and over plain in the clear atmosphere of the "melancholy days," breathing the pure air of heaven until every sinew is strengthened and every nerve braced? while the rocks, as they lie in their lonely beds, speak to him; and the brook, as it goes laughing and dancing onward to its death in the troubled sea, unfolds in its swift and varied course the storied book of nature; while even the trees, swaying to the passing breeze, lift up their heads and with million tongues praise the Author of all Good for the glad sunlight and the smiling land.

Some such cheering influences as these surround and purify the heart of every one whose fortune it may have been to listen to the music of the hound on the echoing hill-side, or to thread the thorny brake in quest of the whirring game.

To many all this may seem to be but the "little things of little men," but history teaches us that the knowledge acquired in the chase of wielding a deadly weapon, and the possession of frames hardened by the pleasant toil of many a hunting expedition, have been the means of enabling a people to preserve the freedom of their country when the day of trial and of conflict came.

OOLOGY

OF SOME OF

THE LAND BIRDS OF NEW ENGLAND,

AS A MEANS OF

IDENTIFYING INJURIOUS OR BENEFICIAL SPECIES.

BY E. A. SAMUELS, BOSTON, MASS.

THE science of oology, or study of the eggs of birds, although, apparently, at the first glance, of but little importance to agriculture, may be made, receiving but a reasonable amount of the attention bestowed upon some of the other branches of natural science, of very great assistance to the farmer in the identification of injurious or beneficial species. It is true that the birds, as a class, are beneficial, some eminently so, but there are some species extremely noxious, and although of similar breeding habits with others more beneficial, most of them may be readily identified by an inspection of their nests and eggs. It may be said that the breeding season is extended through but a comparatively short season of the year, and this means of identification seems, therefore, of but little practicability. True, but probably seven-tenths of the birds throughout the country, when destroyed by the farmers for economy's sake, are killed in or near the breeding season, for the reason that they are then most usually found near the farms and plantations, and they are more easily approached, and have less fear of man than at any other time.

As an instance of the assistance oology furnishes, we may take the breeding habits of the diurnal and nocturnal birds of prey. These are almost exactly similar, both as regards localities, time, manner of constructing nests, and the materials used; but the eggs are entirely different, those of the hawks, and other diurnal birds of prey, being generally marked or blotched with different colors, from the ground color, which is usually of a dirty white, and the surface is granulated and rough to the touch, while the eggs of the owls are always pure white in color, nearly spherical in form, and quite smooth to the touch. Now, the habits of these birds are pretty generally known; the hawks, &c., are destroyed at every opportunity, because of being extremely noxious, and the owls are spared and protected because of their persistent efforts in the destruction of those small injurious rodentia, the field-mice, rats, &c. It is true that the breeding characteristics have less importance in other birds than in the rapacia, because most of them are beneficial, and therefore worthy the attention and protection of the farmer; but still, there are numerous instances in which a knowledge of their breeding habits has been of great value; and, as the subject is at the present time receiving a great deal of attention from scientific men, it seems proper that the farmers should have, at least, a general knowledge of its merits. Of course, in a country like New England, embracing so large and diversified an area, there must be considerable variation in the arrivals of birds, and times and localities of breeding. There must also be, in some localities, a great abundance of some species which in others are comparatively scarce; but I cannot, in so short a paper as the present, speak in much more than general terms of the habits of each species, and must content myself with giving their

general distribution, time of arrival on the average, at the latitude of about the middle of Massachusetts, a brief account of their habits, and a description of the nests and eggs.

The classification and nomenclature that I have adopted in the following pages are those used by Professor Baird, and other eminent ornithologists in this country. For a full analysis I would refer the reader to the ninth volume of the Reports of the Pacific Railroad Survey.

FALCONIDÆ.

In this family are included all the diurnal birds of prey found breeding in New England. They are, with one or two exceptions, injurious, as they destroy, in fact, subsist almost entirely upon, the smaller beneficial birds. In consequence of their retiring to the solitude of the deep forests in the breeding season, and often choosing the most inaccessible places for nesting, their breeding habits are generally not well known.

DUCK HAWK—GREAT-FOOTED HAWK, (*Falco anatum.*)—Bonap.*

There are but two cases on record in which this rare and exceedingly interesting species has been found to breed in New England: one where a pair bred for a number of years on Mount Tom, in Massachusetts; the other case was a pair that bred on Talcott mountain, Connecticut, a few miles southwest of Hartford. In both instances the nesting place chosen was an almost inaccessible shelf on a high cliff, and I believe that in such localities this species always chooses an eyrie.

It seems to be a resident of New England throughout the year, but, although pretty generally distributed over the continent, is in no section abundant. It is oftener found in the neighborhood of the sea-coast than in the interior. It is a powerful bird, of rapid flight and great boldness and courage, and is the terror of the water-fowl, which constitute the greater portion of its food. The breeding season of this species is very early; it commences building its nest by the first of April. This is constructed of twigs, grasses, and sometimes sea-weeds; it is not much more than a mere platform, being scarcely hollowed. The eggs are from two to four in number; their form is almost spherical, and their color is of a reddish brown, covered with numerous minute spots and dotting of a darker shade. The dimensions of the only two specimens accessible to me at present are 1.90 inch in length by 1.75 in breadth, and 1.85 inch in length by 1.72 inch in breadth. Dr. Brewer gives the dimensions of a single specimen in his collection as 2 inches in length by $1\frac{9}{10}$ in breadth. These measurements will probably include the variations of the eggs of this species. It is to be regretted that so little is known regarding the breeding habits of this bird, and it is to be hoped that the student will hereafter pay particular attention to the investigation of its distribution, habits, &c.†

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* For synonyms, &c., see Vol. IX Pacific Railroad Report.

† Since the foregoing was written, the following extract from a very complete account by J. A. Allen, of the breeding habits of this species, has been received. It is from a paper prepared for the Essex Institute, and published in the proceedings, volume IV:

"It has recently been ascertained that the duck hawk regularly breeds on several of the mountains in and near the Connecticut River valley, the young having been procured from Mount Tom and Sugar-loaf mountain, in Massachusetts, and from Talcott mountain, ten miles west of Hartford, in Connecticut. From accounts that I have received from different persons of a hawk agreeing in habits with the noted duck hawk, I am fully satisfied it has long nested on some of the precipitous mountains bordering on the Connecticut river, in the States of Vermont and New Hampshire. Mr. J. G. Boardman says it breeds on the cliff of the Grand Menan, where it is a resident the whole year. Although the young have been procured, as above stated, from Mount Tom and Sugar-loaf mountain several times in the last few years, and, according to Dr. W. Wood, from Talcott mountain, I am not aware that

Pigeon Hawk—Bullet Hawk, (*Hypotriorchis columbarius.*)—Gr.

This species is a common spring and fall visitor throughout New England, and, as specimens are not uncommonly observed through the summer months, it is not improbable that it breeds here, although I do not remember of an authenticated instance. I have no egg in my collection of this bird, and have never met with its nest. There seems considerable confusion regarding this species, both as to its nesting place and its eggs. Mr. Hutchins says, (Fauna Boreali Americana, 11, 36,) it "makes its nest on rocks and in hollow trees, of sticks and grass, lined with feathers, laying from two to four white eggs, thinly marked with red spots." Audubon, in describing the eggs, says, (Birds of America): "Mr. Hutchins's description of the eggs of this bird is greatly at variance with my own observations. The eggs, in three instances which occurred at Labrador, were five; they measured an inch and three-quarters in length, an inch and a quarter in breadth, and were rather elongated; their ground color a dull yellowish brown, thickly clouded with irregular blotches of dull, dark reddish brown." Dr. Brewer says, (Synopsis of Birds of North America, as an appendix to Wilson's Ornithology,) it "nests in low fir trees, twelve feet from the ground; eggs, three, dull yellowish brown, with dark reddish brown blotches." Thus there remains, as with the preceding species, much to be learned concerning this bird. It will be found, probably, to breed in the more northern districts of New England, and in mild winters a not uncommon inhabitant of the middle and more southern districts. In fact, I have known of specimens being obtained in the neighborhood of Boston as late as January for several winters.

Sparrow Hawk, (*Tinnunculus sparverius.*)—Vieill.

This beautiful little hawk is a summer inhabitant of all the New England States, and, in the more southern districts, a resident throughout the year. It is not a common species, and its nest is rarely found. "The universal observation has been that this species, instead of building a nest, avails itself of a hollow tree," (Wilson;) or "the deserted hole of a woodpecker, or even an old crow's nest."—(Dr. Brewer.) Although I have had quite a number of the eggs of this bird, I have, although repeatedly searching for its nest in many localities, been able to meet with but one. This was built in a crow's nest of the previous year, in a hemlock tree, about thirty feet from the ground. There had been apparently but few alterations of the old nest, these consisting principally of the addition of a few loose sticks and twigs to the interior of the nest, making it nearly a flat platform. The locality was the valley of the Magalloway river, about twenty-five miles north of Lake Umbagog, Maine. The eggs were four in number, and these, with several other specimens collected in Upton, Me., Calais, Me., and Williamstown, Mass., are before me. I am inclined to think, from what I can learn from collectors and others, that four is the usual number laid by this bird—probably seldom more. Their ground color varies from a deep cream or yellowish buff to a pale reddish white; this is covered, more or less thickly in different specimens, with spots and confluent blotches of reddish brown and Vandyke brown, or chocolate. Their form is nearly spherical, being but very little pointed at either end. Their dimensions vary from 1.40 inch by

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the eggs have been found in New England, or even in the United States, before the present season, when they were procured from a nest on Mount Tom, (April 19, 1864,) by Mr. C. W. Bennett, of Springfield. The only egg figured by Dr. Brewer was from Greenland, and its authenticity not ascertained wholly without doubt. Dr. Brewer mentions a drawing in his possession of another egg from Labrador, by Dr. Tradeau, these being the only specimens to which he then had access. The average length of these eggs was 2.22, breadth 1.68, but in the four specimens the length varied sixteenth of an inch and in breadth one-sixth of an inch.'

1.15 inch to 1.30 inch by 1.13 inch. This species breeds later than most of the other birds of prey, as the eggs which I found in Maine on the 11th of June, 1864, were newly laid.

COOPER'S HAWK, (*Accipiter Cooperii.*)—Bonap.

This bird is probably the most common hawk breeding in New England. In my collecting trips my experience has been that I have found certainly two nests of this species for one of all others. Its habits and breeding places are well known, as it is the smallest of those hawks known to the farmers by the descriptive name, the "hen hawk." In great numbers of nests that I have examined I have found no great variation in character; they were almost invariably in a fork of a tall tree near the top—in three cases out of five in the different pines. They were large bulky affairs, constructed of twigs and sticks, some of them nearly ½ an inch in diameter; they were decidedly hollowed, and often lined with leaves and the loose bark of the cedar. The eggs of this species vary in number from two to four. I do not remember ever finding more than four, which number is usually laid. Their ground color is a dirty bluish white, with often thinly scattered spots of brown, or obscure blotches and markings of a shade darker than the ground color of the egg. A great number of specimens in my collection exhibit a variation in dimensions of from 1.82 inch to 2 inches in length, by from 1.50 inch to 1.62 in breadth. The average dimensions are about 1.78 inch by 1.52 inch. The breeding season varies considerably with this species even in the same latitude. I have found nests with eggs as early as the first week in May, and as late as the first week in June. Usually the eggs are laid before the 20th of May in Massachusetts. The season for the northern district of New England seems to be from one to two weeks later than this; that of the southern district about a week earlier.

SHARP-SHINNED HAWK, (*Accipiter fuscus.*)—Gmelin.

This well-known little species is a general and common summer inhabitant of all the New England States; it makes its appearance with the arrival of the earliest flight of the smaller migratory birds in spring, and remains until the latter part of autumn, and in the southern portions of these States even throughout the winter. Notwithstanding the comparative abundance of this species, its nest, until quite recently, has been quite rarely found. Audubon met with but three, and neither Wilson nor Nuttall ever saw one. I have been so fortunate as to find several, two of which had in each four eggs. They were built in the forks of pine trees, about twenty-five feet from the ground; they were loosely constructed of sticks and twigs, were not much hollowed, and were lined with smaller twigs and a few leaves. Fourteen eggs in my collection, from different parts of New England, exhibit but slight variations; they are of a bluish white color, and covered at the larger end with spots and blotches of chocolate brown; in some specimens these blotches are confluent, making a ring near the large end; others are covered nearly over their entire surface with these markings. The form of the egg is nearly spherical; the length varying from 1.50 inch to 1.23 inch; and the breadth from 1.24 inch to 1.06 inch. Average dimensions about 1.40 inch by 1.20 inch. I have found the eggs as early as the 10th of May, but usually they are not laid before the 20th in the latitude of Massachusetts. The same nest is occupied by the parent birds for several years, and the female is a persistent layer. A case came to my knowledge in the spring of 1864, when the nest was robbed three times; fourteen eggs were removed, and if the female had not been killed when the last eggs were taken, she would probably have laid another litter, as there were several found in her nearly formed.

RED-TAILED HAWK—WINTER FALCON, HEN-HAWK, (*Buteo borealis.*)—Vieill.

This species is a rather common resident of all the New England States throughout the year. Its habits are well known, and they, together with its name, "hen hawk," render it an object of hatred to the farmer and poultry raiser, who lose no opportunity to destroy it; this must account, in part, for the fact that it chooses the most retired spots in the deep forests for its breeding places.

It builds its nest in a lofty fork of a large tree; the nest is one of the largest of our rapacious birds, in one case, to my knowledge, exceeding two feet in width, and twenty inches in depth; it is constructed of large sticks and twigs, is but slightly hollowed, and is lined with smaller twigs, leaves and moss. The eggs are generally three in number—seldom more; their ground color is a dirty yellowish white, with obscure blotches of a yellowish brown, and sometimes distinct blotches of a darker brown. Their form varies from nearly spherical to ovoidal, but they are, generally, nearly as large at one end as at the other. Dimensions of specimens vary from 2.12 to 2.25 inches in length, by from 1.68 to 2 inches in breadth.

RED-SHOULDERED HAWK, (*Buteo lineatus.*)—Jardine.

This bird is a rather common resident of all New England throughout the year. Audubon, in describing its breeding habits, says:

> "At the approach of spring this species begins to pair, and its flight is accompanied with many circlings and zigzag motions, during which it emits its shrill cries. The male is particularly noisy at this time. He gives chase to all other hawks, returns to the branch on which his mate has chanced to perch, and caresses her. This happens about the beginning of March—(May in New England.) The spot adapted for a nest is already fixed upon, and the fabric half finished. The top of a tall tree appears to be preferred by this hawk, as I have found its nest more commonly placed there, not far from the edges of woods, bordering plantations. The nest is seated in the forks of a large branch, towards its extremity, and is as bulky as that of the common crow. It is formed, externally, of dry sticks and Spanish moss, and is lined with withered grass and fibrous roots of different sorts, arranged in a circular manner. The female usually lays four eggs, sometimes five."

I have been so fortunate as to meet with several nests of this species, and I have not found them to differ very materially from the above description, except in the size. A nest that I found in Milton, Massachusetts, was built in a fork of a large oak, against the trunk, about forty feet from the ground; it was of a bulk nearly sufficient to fill a basket; it was considerably hollowed and lined with dry grass and leaves. The eggs, two in number, are in the cabinet of Dr. Brewer, who describes them as follows:

> "Two others belonging to this species, obtained in Milton, Massachusetts, by Mr. E. A. Samuels, and identified by securing the parent birds, may be thus described: One measures $2\frac{1}{16}$ by $1\frac{10}{16}$ inch; the ground color is a dirty white, and is marked with large blotches, lines, and dottings of umber-brown of various shades from quite dark to light. The other is 2 inches by $1\frac{10}{16}$, has a bluish white ground, and is only marked by a number of very faint blotches of yellowish brown and a slate drab. Except in their shape, which is an oval spheroid, slightly pointed at one end, these bear but very slight resemblance to each other, though taken at the same time from one nest."

A number of specimens in my collection exhibit as great a variety as the above instances, and one specimen, obtained in Connecticut, which measures 2.12 by 1.65 inches, has a dirty yellowish white ground color, which is nearly covered with blotches of faint purple; the appearance being as if the purple spots were laid on, and then a coating of whitewash laid over them.

BROAD-WINGED HAWK, (*Buteo Pennsylvanicus.*)—Wilson.

This bird, common in no part of the country, is quite rare in New England, and its nest and eggs are very seldom met with. I have found but one in all

my collecting trips, and this was, fortunately, supplied with four eggs. The locality was West Roxbury, Massachusetts, and the time about the 20th of May, 1864. The nest was quite large; it was placed in a fork of a tall pine tree, about thirty feet from the ground. It was constructed of twigs and sticks, and was lined with fragments of an old crow's nest, or that of the common red squirrel; it was not much hollowed, and seemed scarcely more than a mere platform. The eggs vary from 2 by 1.70 inches, to 2.15 by 1.72 inches; their color is a dirty yellowish white, covered more or less thickly in the different specimens with spots and blotches of reddish brown; another egg, obtained in Newton, Massachusetts, in the previous season, is somewhat smaller, and the markings are fainter, and of a lighter color. There are but three instances on record of this species breeding in New England, the above are included in these.

MARSH HAWK—HARRIER, MOUSE HAWK, (*Circus Hudsonius.*)—Linn.

This species is a common summer inhabitant of all the New England States. It arrives from the south from about the middle of April to the first of May. I am inclined to think that the birds are generally mated before their arrival, for they are almost always seen in pairs from their first appearance. In choosing a situation for a nest, both birds are remarkably nervous and restless; they are almost constantly on the wing, prying into, and apparently taking into account everything with reference to future comfort. The following circumstances came to my observation, and, as I improved every opportunity to watch the proceedings, will serve to illustrate the breeding habits of this bird. A pair made their appearance about the middle of April, a few years since, in a large meadow, in Dedham, Massachusetts. They were apparently mated from the first, and as the neighborhood gave promise of an abundance of food, (field mice,) I concluded that this would be selected as a breeding place, and watched accordingly; the male was very attentive to his mate, often talking to and caressing her; if she should alight on the ground, or on a fence rail, he would alight with her, and often fly and walk around her, bowing and chattering in a ludicrous manner. After a situation (luckily where I could watch them unobserved) was fixed upon for a nest, both birds were very active in its construction. It was built on a hummock, perhaps eighteen inches above the level of the meadow; the materials used in its construction were dried grasses, which were woven together rather neatly; it was considerably hollowed, perhaps an inch and a half, and lined with very soft grass; the external diameter of the nest was about eighteen inches; internal diameter about eight inches. The female laid four eggs of a dirty-white color, with a faint tinge of blue; in one specimen there were a few faint spots of brown; but I think that generally the eggs of this species are without spots. I have seen a great many, and but a very few had spots, and these not at all distinct. A great number of specimens exhibit a variation of from 1.62 to 1.90 inch in length, and from 1.32 to 1.25 inch in breadth. The habits of this bird entitle it to the protection of the farmer. It subsists almost entirely upon the injurious field-mice, and the numbers of these animals that it destroys in the breeding season are incredible; from early dawn to dim twilight it may be seen busily searching for these pests, seldom molesting the small beneficial birds or poultry. Dr. Brewer, in describing the eggs of this species says:

"With but a single exception, all these eggs (six) are very distinctly blotched and spotted. Their ground color is a dirty bluish white, which in one is nearly unspotted, the markings so faint as to be hardly perceptible, and only upon close inspection. In all the others spots and blotches of a light shade of purplish brown occur, in a greater or less degree, over their entire surface. In two the blotches are large and well marked, in the others less strongly traced, but quite distinct. This has led to a closer examination of eggs from other parts of the country, and nearly all are perceptibly spotted."

The great number of specimens to which Dr. Brewer had access, and his great experience, entitle his remarks to the highest respect, and, therefore, I would say that, although I have met with but few spotted eggs of this species, it is not improbable that the student and collector may observe hereafter a large proportion spotted, at least, to some extent.

GOLDEN EAGLE, (*Aquila Canadensis.*)—Mohring.

That this species occasionally breeds in New England is already known, and I regret that I am unable to add anything to our knowledge of its habits and breeding peculiarities. Dr. Brewer says, "It breeds in the mountainous portions of Maine, New Hampshire, Vermont, and New York." The golden eagle usually constructs its nest on the sides of steep rocky crags, where its materials are coarsely heaped together on a projecting shelf of rock. These consist of large sticks loosely arranged. In rare instances they are said to have been built on trees in the western States, where rocky cliffs are not to be met with. The eggs are usually three in number; sometimes two, or only one. Mr. Audubon describes them as measuring 3½ inches in length by 2½ in breadth; the shell thick and smooth, dull white, brushed over with undefined patches of brown, which are most numerous at the larger end. This description is probably not quite accurate in regard to size. This species is not common in any part of the continent, and is extremely rare in New England.

WHITE-HEADED EAGLE—BALD EAGLE, (*Halietus leucocephalus.*)—Savigny.

This well-known bird is a resident of all the New England States throughout the year. It is never common in these States, but breeds in all of them, much oftener in Maine, however, than in either of the others; it generally chooses for a breeding place a retired spot in the neighborhood of a tract of water. The nest is generally placed in the fork of a large dead tree, and is occupied by the same pair of birds for successive years. I am informed that a pair of these birds have, for a number of years past, made their eyrie on a shelf of an inaccessible cliff on the side of what is called "Diamond mountain," a few miles south of the Umbagog lakes. Mr. J. A. Allen says that this species (Catalogue of Birds of Springfield, Mass., in Proceedings of Essex Institute, vol. 4, No. 2) "sometimes breeds on Mount Tom, about twenty miles north of Springfield, Massachusetts." These are probably, however, exceptional cases. The nest is constructed of large sticks, twigs, branches of sea-weeds, turf, and moss; some of these sticks are nearly or quite an inch in thickness. It is a bulky affair, its diameter often being five feet and its thickness from two to three feet. It is not much hollowed, and is nearly level across the top. Of numbers of eggs of this bird that I have examined I could see no material difference as to shape or color, the form being nearly spherical and the color a dirty yellowish white. Length of specimen varies from 2.93 to 3.07 inches, breadth from 2.31 to 2.47 inches.

FISH HAWK—AMERICAN OSPREY, (*Pandion Carolinensis.*)—Bonap.

This species, so very generally distributed over the entire continent, is a summer inhabitant of all the New England States; it is not common, however, in districts removed from the seaboard, and breeds almost entirely in localities near or on islands in the ocean. The birds make their appearance in the spring, generally with the herrings and shad; their arrival is welcomed by the fishermen, who, although of the same trade, never molest them, but even take them under their protection. Wilson says, "such is the respect paid the fish hawk, not only by this class of men, but generally by the whole neighborhood where it resides, that a person who should attempt to shoot one of them would stand

a fair chance of being insulted." The nest of this species is usually built in a fork near the top of a dead tree; it is constructed of sticks, twigs, pieces of turf, sea-weed, &c.; it is a bulky fabric, often four or five feet in diameter, and three feet in depth. It is occupied by the same birds for successive years. This species arrives in New England from about the 10th of April to the 1st of May, and the eggs are usually laid before the 10th of May; they are generally three in number. They vary considerably, both in shape, size, and markings. In a majority of specimens in my collection the ground color is a rich reddish-cream, and covered with numerous blotches of different shades of brown. In a number of specimens these blotches are confluent, and the primary color is nearly hidden. Their form varies from nearly spherical to ovoidal, and the dimensions from 2.28 to 2.44 inches in length, and from 1.65 to 1.83 in breadth. This bird subsists entirely upon fish which it captures while on the wing by diving and seizing its prey in its talons. It is of a peaceable disposition and never molests any of its feathered tribe. If the nest is plundered the parent bird attacks the intruder and often inflicts ugly wounds in its defence.

STRIGIDAE.

In this family are included our owls; these birds, with the exception of the great horned owl, are all beneficial.

BARN OWL, (*Strix pratincola.*)—Bonap.

This bird is exceedingly rare in New England, and I know of no authenticated case of its breeding here; but Dr. Thompson, in his Birds of Vermont, says, "I am assured by Dr. Brewer that it is not only found in Vermont but breeds here;" I therefore include it, on this authority, in the birds breeding in New England. The eggs are described as being of a dirty yellowish-white, without any spots, measuring $1\frac{11}{16}$ inch in length by $1\frac{3}{16}$ and $1\frac{4}{16}$ inch in breadth.

GREAT HORNED OWL—CAT OWL, (*Bubo Virginianus.*)—Bonap.

This well known bird is a resident in all the New England States throughout the year. It is not so common in Massachusetts, Connecticut, and Rhode Island as in the other States, where in the vast tracts of forest it is quite common—so much so, that I have heard several of them at the same time making "night hideous with their discordant, mournful cries." Never shall I forget a serenade I once had the pleasure of hearing in the State of Maine, in which this bird maintained the basso. We were encamped on the shores of Lake Umbagog; our tent was pitched on a bluff overlooking the lake, and behind us was the deep dark forest of pines and hemlocks. We had just got fairly into our first nap, the sweet follower of our day's toils, when we were awakened by the hootings of one of these owls, "*waugh, hoo, hoo, hoo,*" or "who cooks for you?" as the western traveller understood it, which seemed to be addressed to us from a tree almost over our tent. We listened: presently another took up the theme, and then both together. They had scarcely finished their duett, when from away up the lake came the shrill, mournful cry or scream of the loon; this was continued and answered by others until, with owls and loons, the night was vocal with melodious sounds. After this had died away and all was still, there came from a bush near our tent the almost heavenly song of the white-throated sparrow, the "nightingale of the north." One cannot imagine the effect produced by the contrast; he must be on the spot in the dark night, and through the sighing of the winds amid the grand old trees hear the owls and loons, then silence, then the beautiful song of the nightingale. Notwithstanding the abundance of the great horned owl in New England, its nest is rarely found.

It chooses for its breeding places the most retired and inaccessible places in the deep forests, and the student might search for weeks for its nest and not find it unless by accident. It is usually built in a fork of a tall tree, but is sometimes made in a hollow of a tree or in the top of a stub or stump. Audubon found it twice in fissures of rocks. It is constructed of sticks and twigs, and is lined with leaves, grasses, and moss. The eggs are usually three in number, sometimes four, rarely more; they are of a white color, with a very faint yellowish tint; their shape is nearly spherical, and they average in size 2.25 inches by 2 inches. The destructive habits of this bird are well known; it subsists principally upon partridges, quails, pigeons, and other wild game birds, and often makes a raid on the poultry that roosts in trees near the farm-houses. It is in consequence detested by the farmers, who improve every opportunity to destroy it. Almost every specimen when killed smells strongly of the odor of the skunk, which shows that these beneficial nocturnal animals contribute to its food.

MOTTLED OWL—SCREECH OWL, (*Scops asio.*)—Bonap.

This handsome little owl is a common resident of New England throughout the year. It selects for a nesting-place a hollow tree, often in the orchard, and commences laying at about the first of May, in the latitude of the middle of Massachusetts. The nest is made at the bottom of the hollow, and is constructed of grass, leaves, moss, and sometimes a few feathers. It is not elaborately made, being nothing more than a heap of soft materials. The eggs are usually four in number; they are pure white, smooth, and nearly spherical in form. Their length varies from 1.30 to 1.37 inch; breadth from 1.18 to 1.25 inch.

LONG-EARED OWL, (*Otus Wilsonianus.*)—Lesson.

This species is a common resident of all the New England States throughout the year. It seems to prefer the neighborhood of civilization, and has been found breeding quite plentifully within five miles of Boston. I have been so fortunate as to find several nests, all of which were built in forks of tall pines, and constructed of twigs and leaves. Audubon says:

"The long-eared owl is careless as to the situation in which its young are to be reared, and generally accommodates itself with the abandoned nest of some other bird that proves of sufficient size, whether it be high or low, in the fissure of a rock or on the ground. Sometimes, however, it makes a nest itself, and this I found to be the case in one instance near the Juniata river, in Pennsylvania, where it was composed of green twigs, with the leaflets adhering, and lined with fresh grass and wool, but without any feathers."

Wilson describes its breeding habits as follows:

"About six or seven miles below Philadelphia, and not far from the Delaware, is a low swamp, thickly covered with trees, and inundated during a great part of the year. This place is the resort of great numbers of the qua bird, (night heron,) where they build in large companies. On the 25th of April, while wading among the dark recesses of this place, observing the habits of these birds, I discovered a long-eared owl, which had taken possession of one of their nests and was setting. On mounting to the nest I found it contained four eggs, and, breaking one of them, the young appeared almost ready to leave the shell. There were numbers of the qua birds' nests on the adjoining trees all around, and one of them actually on the same tree."

The reader will perceive from the above account of the breeding habits of this bird that it is variable in its choice of a nesting place, although every nest that I have found, or known of, was built in tall pines and constructed as above; and I have known instances where the same nest was used for successive breeding seasons.

The eggs are generally four in number—seldom more. They are nearly spherical in form, and of a pure white color. Dimensions of specimens in my collection vary from 1.40 to 1.60 inch in length, by from 1.30 to 1.40 inch in breadth.

Short-eared Owl, (*Brachyotus Cassinii.*)—Brewer.

I have no doubt that this species breeds in New England, as I have known of specimens being shot in Massachusetts in mid-summer; but there are no authenticated cases on record of its breeding here, and it is to be hoped that the student and collector will pay particular attention to the increasing of our knowledge of its habits. Richardson says that its nest is formed of withered grass and moss, and is built on the ground. Dr. Bryant (Proceedings of Boston Society of Natural History, January, 1857) describes a nest found on an island in the Bay of Fundy as follows:

"A nest of this bird was found by Mr. Cabot in the midst of a dry peaty bog. It was built on the ground, in a very slovenly manner, of small sticks and a few feathers, and presented hardly any excavation. It contained four eggs on the point of being hatched."

The eggs of this species are of a pure white color, and vary in dimensions from 1.46 inch by 1.25 inch to 1.50 inch by 1.27 inch.

Barred Owl, (*Syrnium nebulosum.*)—Gray.

This owl is a not uncommon resident of the New England States throughout the year. Dr. Brewer says of its breeding habits:

"I have never met with the nest of this bird, but Mr. Wilson describes one formed in the crotch of a white oak, among thick foliage, as rudely put together, composed outwardly of sticks, intermingled with some dry grass and leaves, and lined with smaller twigs. Mr. Audubon speaks of them as breeding in hollows of trees, and at other times as taking possession of the old nest of a crow hawk."

The egg is purely white, almost globular, and, except in shape, hardly distinguishable from the egg of the domestic hen. It is 2 inches in length, 1.68 in breadth.

Saw-whet Owl—Acadican Owl, (*Nyctale acadica.*)—Bonap.

Mr. A. E. Verrill, in a list of the birds of Maine, published in the Proceedings of the Essex Institute, vol. iii, page 136, says that this bird is a common resident in that State, and that it breeds there. I have known of specimens being shot in Massachusetts in summer, and think that there may be some breeding in this State, but I am inclined to think that the species is rare in New England. It "nests in the hollows of trees, often only a few feet from the ground, in the deserted nests of other birds, in the crevices of rocks, and in thick pine trees." The eggs are nearly spherical, are of a bright, clear white, and more like a woodpecker's than an owl's in their crystalline clearness. Dimensions, $1\frac{2}{16}$ by $1\frac{4}{16}$ inch.

Hawk Owl—Day Owl, (*Surnia ulula.*)—Bonap.

I have known of several specimens of this bird being obtained in Vermont and New Hampshire, and I have no doubt that it occasionally breeds in New England, but the cases must be very rare indeed, as the bird is itself very seldom met with except in the Arctic regions. In the Fauna Boreali Americana we find an account of its breeding habits, which is, that it builds on a tree; its nests consist of sticks, grass, and feathers; it lays two white eggs.

In dismissing the rapacious birds, I must ask for the indulgence of the scientific reader, as this paper is written more for the guidance of the farmer, or other unscientific observer, than for the student and naturalist. I have rejected everything conflicting with my own experience, or not recorded by the most eminent authorities. The next order of birds in the system we have adopted is the scansores, or climbers. These birds are distinguished from all others by the manner in which the toes are placed, namely, two in front of the foot and two behind. We have but few birds of this order in New England, and those are eminently beneficial; they are included in the cuckoos and woodpeckers.

YELLOW-BILLED CUCKOO, (*Coccygus Americanus.*)—Bonap.

This species is a not uncommon summer inhabitant of all the New England States; it is not so common in the more northern districts as the black-billed cuckoo, and seems to grow less common every year. It arrives in New England from about the 25th of April to the 1st of May. About the middle of May, immediately after pairing, the birds commence building on a low bough of a tree or in a thicket of bushes, usually the barberry, a loose, straggling nest. The materials used are chiefly twigs of different sizes. I have examined a number of these nests, and they were all nearly flat across the top and lined with twigs of a finer quality than those used on the exterior. The eggs are usually four in number, of a light greenish-blue color, and almost invariably larger than those of the black-billed cuckoo. Length of specimens varies from 1.07 to 1.25 inch; breadth from .84 to .96 inch. From the fact that the greater part of the food of the cuckoos consists of caterpillars and larvæ of various injurious insects, they can with justice be called great friends of the farmer, who should take them under his protection instead of improving every opportunity, as too many, unfortunately, do, of destroying them.

BLACK-BILLED CUCKOO, (*Coccygus erythrophthalmus.*)—Bonap.

This species arrives from the south about the 1st of May, and spreads pretty generally throughout New England. It is much more common in the northern districts than its yellow-billed cousin. Wilson says: "The nest of this bird is most commonly built in a cedar, much in the same manner, and of nearly the same materials, as that of the other." I have found them built in scrub oaks, alders, and even barberry bushes. About the 20th of May the eggs are laid; these are usually four in number, and of a greenish blue color, darker and bluer than those of the other species. Their dimensions vary from 1 to 1.12 inch in length by from .84 to .92 inch in breadth. Dr. Thompson, in describing the nest of this bird in his Natural History of Vermont, says the "nests are made of twigs, and lined *with moss.*" I am inclined to think that such is not the case, at least to any great extent. In numbers that I have examined they were invariably constructed of twigs, nearly flat, and lined (if the expression can be used in this case) with fine twigs and slender, pliable roots.

HAIRY WOODPECKER, (*Picus villosus.*)—Linn.

This species, although not uncommon in the fall, winter, and spring throughout New England, is very seldom observed in the summer months, and probably the greater portion retire to the north to breed. I have known of instances of its breeding in Massachusetts, but they were rare cases. This woodpecker commences its building operations quite early, often by the 20th of April. The nest is made by excavating in old trees in the woods and orchards; the hole made is often as much as eighteen inches in depth, in some cases hardly five inches. A post in a fence is sometimes taken for a breeding place, the hole in which the rail is inserted furnishing a starting place for the excavation of the nest.

The eggs are usually five in number, seldom more, more often less; they are of a beautiful clear white color, and the shell is very smooth and rather thin, and before the contents of the egg are removed they impart a rosy tint to the color. Specimens vary in size from .77 to .84 inch in length, by from .62 to .68 inch in breadth.

DOWNY WOODPECKER—SAPSUCKER, (*Picus pubescens.*)—Linn.

This, the smallest of our woodpeckers in New England, is quite common, being a resident throughout the year. It breeds as readily in the orchards and

gardens near the farm-houses as in the deep forests. I have found numbers of the nests in apple trees within a few rods from houses, and in decayed trees miles from human habitation. The nest and eggs are of the same description as the hairy woodpeckers, excepting with regard to size, the eggs of the present species being considerably smaller on the average, measuring from .73 to .77 inch in length, by from .60 to .63 inch in breadth. I think that the nests of this species, as with some others, are used for successive seasons, as I have found, apparently, old nests occupied by breeding birds. I am not aware that the hairy woodpecker uses the same nest several seasons. The downy woodpecker sometimes rears two broods in the southern portion of New England; usually but one.

BLACK-BACKED, THREE-TOED WOODPECKER, (*Picoides arcticus.*)—Gray.

This bird is rarely met in New England, save in the most northern districts, and I believe it has never before been ascertained to breed here. I was so fortunate as to find two nests in the month of June, 1864, both in the valley of the Magalloway river, about forty miles north of Lake Umbagog, Maine. The holes were both excavated in hemlock stumps about ten feet from the ground; they were not over an inch and a half in diameter, and about ten inches in depth; the bottom of the hole formed the nest, which as with the other species, was nothing but a few chips and bits of wood. The first nest, found on the 15th of June, had three young birds apparently about a week old. The second nest had three eggs; these were of a beautiful clean white color, and the shells remarkably smooth to the touch. Their dimensions varied only from .83 to .85 inch in length, by .75 to .77 inch in breadth.

YELLOW-BELLIED WOODPECKER, (*Sphyrapicus varius.*)—Baird.

This handsome species is not a common summer inhabitant of all the New England States, and seems to be less often met with near the sea-coast than in the interior. J. A. Allen, in his catalogue before referred to, says:

> "I have never seen this species in summer, and do not think it breeds here, though they breed plentifully on the hills in western Massachusetts, twenty or thirty miles west of Springfield."

It arrives from the south from about the 10th to the 20th of April. About the 1st of May it commences excavating its hole, which is usually in a decayed tree in the woods, but occasionally in a sound tree. This excavation is often eighteen or twenty inches deep. The eggs are usually five in number; they are of a pure white color, and small for the size of the bird, measuring from .82 to .86 inch in length, by from .74 to .77 inch in breadth. This species is the "sapsucker," so called, of the western States. It need give the farmers of New England no uneasiness, as its numbers are neither great nor destructive in this region.

PILEATED WOODPECKER—BLACK LOG-COCK, (*Hylatomus pileatus.*)—Baird.

This bird is a resident of the northern districts of New England throughout the year. It has been known to breed occasionally in Massachusetts, but, as a general thing, it is not found south of the northern border of this State. Verrill, in his catalogue of Maine birds, before referred to, says it is a common resident and breeds; he also says that it is most common in winter. I have never been so fortunate as to meet with the nest of this species, and must depend for a description of its breeding habits on the observation of others. Mr. Audubon says, (quoting from a letter written by Rev John Bachman,) in describing its nest:

"The hole was about eighteen inches deep. and I could touch the bottom with my hand. The eggs, which were laid on fragments of chips expressly left by the birds, were six, large, white, and translucent. Before the woodpeckers began to set I robbed them of their eggs to see if they would lay a second time. They waited a few days, as if undecided, when on a sudden I heard the female at work again in the tree, once more deepened the hole, made it broader at the bottom, and recommenced laying. This time she laid five eggs."

Wilson, in a very interesting account of the general habits of this bird, says:

"Almost every trunk in the forest where he resides bears the marks of his chisel. Wherever he perceives a tree beginning to decay, he examines it round and round with great skill and dexterity, strips off the bark in sheets of five or six feet in length to get at the hidden cause of the disease, and labors with a gaiety and activity really surprising. He is sometimes observed among the hills of Indian corn, and it is said by some that he frequently feeds on it. Complaints of this kind are, however, not general; many farmers doubting the fact, and conceiving that at these times he is in search of insects which lie concealed in the husk. I will not be positive that they never occasionally taste maize, yet I have opened and examined great numbers of these birds, killed in various parts of the United States, from Lake Ontario to the Alatamaha river, but never found a grain of Indian corn in their stomachs."

This species commences laying about the 20th of May in the latitude of Massachusetts.

Red-headed Woodpecker, (*Melanerpes erythrocephalus.*)—Swainson.

This handsome woodpecker is a not very common summer inhabitant of New England. It makes its appearance from the south about the 10th of May, and soon commences excavating a hole in some tree in a retired situation for its nest; this hole is from fourteen to eighteen inches deep, and, like other woodpeckers, is roomy at the bottom, and tapering gradually to the entrance, which is only large enough for the comfortable passage of the bird. The eggs are generally six in number, and, so far as my experience goes, of a beautiful clear white color, (Dr. Thompson says, in his "Birds of Vermont," that they are marked with reddish spots at the large end,) and the shell is smoother than that of any other woodpecker's egg of my acquaintance. Length of specimens vary from 1.07 to 1.12 inch, breadth from .77 to .84 inch.

Golden-winged Woodpecker—Yellow Hammer, Flicker, (*Colaptes auratus.*)—Swainson.

This is a very common summer inhabitant of New England. It is probably the most common of all the woodpeckers, and is very generally known. It is in the southern districts of these States a resident throughout the year, and in Massachusetts I have often met with it in midwinter, when the season was not of the mildest either. Great numbers arrive from the south at about the second week in March.

The birds are a considerable time in pairing, and many are the little attentions and fondlings paid by the male for the preference of the female. At last, when the thing is arranged, the birds seek for a suitable place to commence housekeeping. This is at from the middle to the last of May, according to latitude. The tree fixed upon for a nesting place, both birds commence excavating a hole, which is often as much as twenty inches in depth, and in a solid tree very often at that. On the bottom of this hole the female lays six pure white eggs; these are generally of uniform shape, and vary in size from 1 to 1.16 inch in length by from .82 to .92 in breadth.

This species may be considered as one of the most valuable birds on the farm, and should receive the protection of the farmer. Its food consists principally of insects, and this fact, when coupled with its great numbers, shows the importance of its services.

Ruby-throated Humming Bird, (*Trochilus colubris.*)—Linn.

This beautiful little bird is a very common summer inhabitant of New England. It is the only species of humming bird that is found here, and its habits and breeding places are consequently well known.

It arrives from the south about the 10th to the middle of May, according to latitude. The birds arrive in pairs, so far as my experience goes, and soon commence building. The nest is composed of a down that is taken from the stems of some of the ferns; this is covered entirely with lichens, which are glued on with the saliva of the bird, giving it the appearance of a mossy knot. This is built on the upper side of a limb, but I have known of cases of its being built in a forked twig. The whole fabric is about an inch and a half in diameter, and about that in depth externally; it is hollowed about half an inch, and is three-fourths of an inch in diameter internally; it is lined with soft, downy substances detached from flying seeds. The eggs are two in number, white, and nearly elliptical in shape, being about equal size at both ends. Length of the eggs about .45 inch; breadth about .31 inch. I am inclined to think that in the latitude of New England this bird raises but one brood in the season; but further south it undoubtedly rears two. The period of incubation is ten days. Wilson says that many efforts have been made to raise this bird from the nest; he gives an instance where a brood were kept several months, and fed with sugar dissolved in water. The fact that the food of the humming bird is almost entirely composed of insects, of course renders the making it a pet an impossibility.

Chimney Swallow, (*Chaetura pelasgia.*)—Stephens.

This well known bird is a common summer inhabitant of New England. It arrives in great numbers from the south about the 1st to the 10th of May. Immediately on arriving the birds pair and commence building. The nest is usually built in an unused flue of a chimney; but before the country was settled they bred, and I have no doubt that great numbers of them in thinly settled districts still breed, in hollow trees. The nest is composed of twigs, which are glued together and to the side of the chimney with the saliva of the bird. It is lined with a few feathers and straws. The strength of these structures is wonderful, and they are so durable that I have known of instances of their remaining in the chimney during three seasons. Usually the bird displays great sagacity in the choice of a location for a nest, in securing protection from the storms and the attacks of animals; but occasionally the nest is built in a chimney, which is open at the top sufficiently wide to permit the rain to trickle down the sides; the result is, the moisture softens the glue by which the nest is attached to the chimney, and it is, with its living contents, precipitated to the bottom. Again, if the nest is built too low in the chimney, the young or eggs furnish agreeable food for rats, which, unfortunately, are sometimes found in dwelling-houses in the country to a disagreeable extent. The eggs are generally four or five in number, pure white in color, rather long in shape. Dimensions of five eggs in a nest collected in Upton, Maine, .84 by .44 inch, .81 by .46 inch, .80 by .46 inch, .78 by .48 inch, .76 by .51 inch.

Whip-poor-will, (*Antrostomus vociferus.*)—Bonap.

This familiar species is a summer inhabitant of New England; it arrives from the south about the second week in May. Its habits are not well known, as it is not a very common species, and it inhabits the most secluded spots in the deep woods; but its song is well known to all, as are its nocturnal wanderings in search for insect food. This bird, as also the night hawk, is one of the

most valuable among the feathered tribes to the farmer; its food consists entirely of night-flying Lepidoptera, and the number of these insects destroyed is immense. It constructs no nest, but lays its eggs, which are two in number, in a slight hollow which it scratches in the earth, usually near a rock or fallen trunk of a tree. These eggs are of an elliptical form, being as large at one end as at the other; their ground color is a delicate creamy white, with blotches, lines, and spots of different shades of light brown and lavender; taken altogether, it is one of the handsomest eggs found in New England. Length of specimens varies from 1.21 to 1.27 inch; breadth from .75 to .79 inch. The bird commences laying about the last week in May, and the period of incubation is fourteen days.

NIGHT HAWK, (*Chordeiles popetue.*)—Baird.

Like its cousin, the whip-poor-will, this bird is a common summer inhabitant of New England, arriving and breeding at about the same time. It constructs no nest, but lays its eggs on the bare ground in a slight hollow scratched by the female, or often on a bare rock. I have found great numbers of these eggs, particularly in the northern parts of Maine, where, in walking over a pasture or rocky field, I have flushed sometimes a bird in every ten rods. I remember a ledge of rocks back of the settlement known as Wilson's Mills, which seemed a favorite breeding place for these birds, and in the space of every four or five rods a female was sitting on her eggs. These are two in number, elliptical in shape, of a dirty white color, which is covered with fine dottings of different shades of brown, with obscure markings of slate color, and some spots of lavender. Length from 1.23 to 1.25 inch; breadth from .82 to .85 inch. A great number of specimens from different sections do not exhibit an appreciable variation from these dimensions. In the southern districts it lays about the 20th of May; in the northern about the 10th of June.

BELTED KING FISHER, (*Ceryle alcyon.*)—Boie.

This species is a very common summer inhabitant of all the New England States. It arrives from the south about the 1st of April, often earlier, particularly in early springs; indeed, Mr. Verrill says they are sometimes seen in Maine in winter, and they are often found in the southern districts of these States in this season. The birds on arriving commence pairing, and they soon commence excavating in a sand bank a long, winding hole of about three inches and a half in diameter at the entrance, and gradually larger to the end, at which the nest, composed of grasses, leaves, and feathers, is built—or laid, would, perhaps, be the better term. This hole is sometimes as much as six or eight feet, usually from four to six in length. The female deposits in this nest six eggs usually; these are of a clear white color, and of a nearly spherical shape, being from 1.35 to 1.42 inch in length, by from 1.05 to 1.08 inch in breadth. I am aware that these measurements exceed any heretofore given, but they are accurately taken from a large number of specimens in my collection. Dr. Brewer gives the dimensions as averaging $1\frac{5}{16}$ inch in length by $1\frac{1}{16}$ in breadth. The period of incubation is stated by Audubon and other ornithologists to be sixteen days.

KING BIRD—BEE MARTIN, (*Tyrannus Carolinensis.*)—Baird.

This well-known species is a very common summer inhabitant of New England. It arrives from the south* about the 1st to the 10th of May, and on

* This bird, although one of the true fly-catchers, is hardly considered by the farmer as a friend, its habit of perching near the bee-hive giving it a reputation which usually, at every opportunity, insures its destruction.

pairing commences building about the 20th of May to the 1st of June. The nest is built in a fork of a tree, usually in or near an orchard; it is seldom placed more than twenty feet from the ground. It is constructed of hay, small twigs and stalks, and dried blossoms of weeds; it is deeply hollowed, and lined with fine roots and grasses, and often with horse hairs and hogs' bristles. The eggs are usually five in number; their ground color is a very delicate creamy white, with irregular spatters and spots of different shades of brown, and some obscure spots of lavender. Dimensions of a nest complement of five eggs: 1.06 by .71 inch; 1.04 by .70 inch; 1.02 by .72 inch; 1 by .74 inch; and .94 by .75 inch.

GREAT CRESTED FLY-CATCHER, (*Myiarchus crinitus.*)—Cab.

This species is a rare summer inhabitant of New England. It arrives from the south about the 10th of May in the latitude of Massachusetts—that is, so far as so irregular a visitor may be said to arrive—and spreads throughout these States. It is less rare in the southern districts than in the middle, and hardly penetrates as far north as the latitude of the middle of Maine. It has been ascertained to breed in all these States, and two nests, with their contents, are before me. One of these was found in a hollow tree in Plymouth, Mass., on the 10th of June; the other was found in Middleton, Mass., on the 4th of June. These nests are composed of straws, leaves, feathers, and the cast-off skins of snakes; and it seems a distinguishing characteristic of the nests of this species to have the skins of one or more snakes woven into the other materials. The first of these nests had five eggs; the other three. These are of a beautiful creamy buff, and covered with irregular scratches and lines of different shades of purple. Wilson says of these eggs: "The female lays four eggs, of a dull cream color, thickly scratched with purple lines of various tints, as if done with a pen." Dimensions of eggs vary from .95 by .78 inches to 1 by .80 inch.

PEWEE—PHEBE BIRD, (*Sayornis fuscus.*)—Baird.

This well-known bird is a very common summer inhabitant of all New England. It arrives from the south often as early as the middle of March, sometimes before the last snow-storm of the season. As soon as the birds have paired, usually by the last of April, they commence building. The nest is usually built under a bridge, sometimes under an eave, or ledge of rock, sometimes in a barn, or other building. It is constructed of fine roots, grasses, fine moss, and hairs, which are plastered together, and to the object the nest is built on by pellets of mud; it is hollowed about an inch and a half, and lined with soft grasses, wool, and feathers. The eggs are usually five in number; their color is white, with a very delicate cream tint; there are in each litter, usually, one or two eggs, with a few spots thinly scattered over the larger end; these spots are of a reddish brown. The period of incubation is thirteen days, and two broods are often reared in the season in this latitude. Length of specimens varies from .72 to .78 inch; breadth from .54 to .56 inch.

WOOD PEWEE, (*Contopus virens.*)—Cabanis.

This bird is a common summer inhabitant of New England. It makes its appearance from the south from about the 10th to the 20th of May. It prefers the solitudes of the deep forests to the more open districts, and is a more retiring species than any of its cousins in these States. About the last of May the birds, having chosen their mates, commence building. The nest is built, usually on the horizontal limb of a tree, generally at a height of about twenty feet from the ground; it is composed of pine leaves, with lichens and mosses, which are

fixed on after the manner of the humming bird. I think Nuttall's description of the nest, the best that I have seen, is as follows:

"The nest is extremely neat and curious, almost universally saddled upon an old moss-grown and decayed limb in a horizontal position and is so remarkably shallow, and incorporated upon the branch as to be easily overlooked. The body of the fabric consists of wiry grass or root fibres, often blended with small branching lichens, held together with cobwebs and caterpillars' silk, moistened with saliva; externally it is so coated over with bluish crustaceous lichens as to be hardly discernible from the moss upon the tree. It is lined with finer root fibres, or slender grass stalks."

The eggs are generally four in number; they are very beautiful, being of a very delicate cream color, with blotches and spots of lilac and brown around the larger end; there are two shades of lilac—one obscure, and the other decided, even a lavender. The eggs are generally oval in shape, and but little larger at one end than at the other. Length from .72 to .78 inch; breadth from .54 to .56 inch. But one brood is reared in the season in New England. The period of incubation is fourteen days. The whole family leave for the south quite early in the fall, even by the first week in September.

LEAST FLYCATCHER, (*Empidonax minimus.*)—Baird.

This common and well-known little flycatcher is a very abundant inhabitant throughout New England; it is very often called the small green-crested flycatcher, the *E. acadica* of Baird. This is a mistake; the latter species is never, or, at any rate, very seldom found in New England, but is more common south and west. The least flycatcher arrives from the south from about the 5th to the 15th of May. The birds commence building about the 20th of this month. The nest is built, usually, in a small fork of a limb of an apple tree, in the orchard, and often quite near the house; it is composed of soft fine grass, cobwebs, twine, cotton—in fact, almost anything that will help to make a smooth, compact fabric; the interior is lined with soft grass, bristles, fine roots, feathers, and wool. The eggs are usually four in number, sometimes three, sometimes five; they are of a beautiful creamy-white color, and their form is nearly pyriform, being abruptly tapered to the small end. Dimensions of a nest complement of four eggs taken at random from a large number, collected in different parts of New England: .63 by .50 inch, .64 by .51 inch, .61 by .53 inch, .60 by .53 inch. This species often breeds twice in the season in New England. The period of incubation is thirteen days. This bird, like the rest of the flycatchers, is extremely beneficial on the farm; its food consists entirely of insects, and the quantity destroyed is enormous. It is hardly necessary to recommend it to the protection of the farmer.

WOOD THRUSH—SONG THRUSH, (*Turdus mustelinus.*)—Gmelin.

This beautiful bird, the song thrush, par excellence, is a rather common summer inhabitant of New England. It seems to be pretty generally distributed until it reaches the southern borders of Maine, New Hampshire, and Vermont, when it begins to grow scarce; and when the middle of these States is reached it goes no further, at least to my knowledge, for I have looked carefully for it in the localities about Lake Umbagog and the White mountains, and have failed to meet with a single specimen. It arrives from the south from the 10th to the middle of May—perhaps in some seasons earlier. I think that the birds are, in a great many cases, paired before they arrive, as they are observed in pairs almost always from their first appearance. The nest is built in a retired locality,*

* Mr. Allen says, in catalogue before referred to: "For three successive summers a single wood thrush has lived among the elms and maples of Court Square, Springfield, spending the whole season in its immediate vicinity, pouring out his melodious strains at early dawn, and at various hours of the day till late in the evening, as though in the usual wood haunts of his species."

almost always in the deep woods. It is composed outwardly of grass, leaves, and weeds, bent and twined together; in this is built a nest composed of mud and grass, and the whole is lined with fibrous roots and soft grass and moss; it is placed on a low branch of a tree, or in the branches of a shrub. I give Wilson's description of the nest, not because it is essentially different from my own, but to confirm my own observation, and to help clear up the confusion that exists in many districts concerning the identity of the thrushes. It is as follows:

"The favorite haunts of the wood thrush are low, thick-shaded hollows, through which a small brook or rill meanders, overhung with cedar bushes, that are mantled with wild vines. Near such a scene he generally builds his nest in a laurel or alder bush; outwardly it is composed of withered beech leaves of the preceding year, laid at bottom in considerable quantities, no doubt to prevent damp and moisture from ascending through, being generally built in low, wet situations; above these are layers of knotty stalks or withered grass, mixed with mud, and smoothly plastered, above which is laid a slight lining of fine black fibrous roots of plants."

The eggs are usually four in number; they are of a uniform light blue color, without spots, and with a very slight tint of green; their form is rather long and pointed. The following are the dimensions of a nest complement of four eggs found in Milton, Massachusetts: 1.12 by .68 inch, 1.12 by .69 inch, 1.07 by .70 inch, 1 by .73 inch. But one brood is usually reared in the season in New England.

Hermit Thrush, (*Turdus pallasii.*)—Cabanis.

This bird, although not so well known in the three southern New England States, is quite familiar to the people of the other States in New England. It arrives from the south about the middle of April and passes leisurely to the north, where it arrives about the middle of May. It very seldom breeds in any districts south of the latitude of the middle of Maine, and from thence north it is quite abundant, where it is known by the name of the "swamp robin." I have been so fortunate as to find several nests of this species, and they were all built in low scrubby trees or alders. They were composed of twigs, grasses, and leaves; they were deeply hollowed, and no mud was used in their composition, as with several other species; they were lined with soft grasses and fine fibrous roots. The eggs were in one nest three in number, and in the other, four. This was about the 10th of June; the localities were in the neighborhood of Lake Umbagog, and in the valley of the Magalloway river, in Maine. The eggs of this species are of a somewhat elongated oval form, and their color is a light blue with a very faint tint of green; about one in every four has thinly scattered spots of reddish brown, and occasionally one is met with having an abundance of coarser spots of two shades of brown. Dimensions of specimens from various localities vary from .92 by .65 to .88 by .60 inch.

The hermit thrush has no song in its passage north, but when it arrives at its breeding place its song almost exactly resembles that of the well-known song thrush that breeds so abundantly in the three southern States of New England.

Wilson's Thrush—Tawny Thrush, (*Turdus fuscesens.*)—Stephens.

This quite common species is a summer inhabitant of all New England. It is quite abundant until we reach the southern portions of Maine, New Hampshire, and Vermont, when it begins to grow less common until we reach the latitude of the middle of these States, where it begins to be replaced by the hermit thrush, and soon ceases to occur to the north of this latitude. It makes its appearance from the south about the first week in May, often earlier, and commences building about the 20th of May. The nest is placed usually in a low shrub, or tangled clump of briers, and occasionally on the ground. The situation is usually retired, often in the depths of the woods. The nest is con-

structed of grass, leaves, and weeds; in some cases the outer bark of the grape-vine is the principal material used; it is quite thoroughly made, and is deeply hollowed and lined with fine roots and horse-hair. The eggs are usually four in number, sometimes five; their color is bluish green, deeper than that of the eggs of the hermit thrush, but not so deep as that of the cat bird; their form is generally an oval, sometimes lengthened and sharpened; their average size is about .90 by .66 inch. As in many other eggs, the longest specimens are not always the broadest. The following are the dimensions of four eggs taken at random from a large number of this species: .92 by .64 inch; .88 by .64 inch; .86 by .66 inch; .87 by .67 inch.

OLIVE-BACKED THRUSH—SWAINSON'S THRUSH, (*Turdus Swainsonii.*)—Cab.

This species is the least common of all the New England thrushes. It is rarely observed in its passage through the southern portions of these States, and only begins to choose a home for the summer on arriving at the northern districts. I have looked for it repeatedly, but have not been able to find it south of the latitude of Lake Umbagog in the breeding season, and even there it is not often met with. It arrives in the localities where it breeds about the first week in June. It, in common with the hermit thrush, is called the swamp robin, and can hardly be distinguished from that bird either by its song, which is beautiful, or its breeding habits or nests. The eggs are different; their size is a trifle larger than the others, and of a deeper green color; they are always (so far as my experience goes) spotted with fine dots of brown. The following are the dimensions of four eggs that I found in a nest near Wilson's Mills, Maine, on the 16th of June, 1864: .93 by .64 inch; .93 by .63 inch; .92 by .60 inch; .90 by .61 inch.

ROBIN, (*Turdus migratorius.*)—Linn.

This very common and well-known bird is a summer inhabitant of all New England, and in mild winters remains in the southern districts of these States through the year. The great body of the birds, however, arrive from the south about the middle of March. They commence building from the middle of April to the first week in May, according to latitude. The nest is built more often in the trees of the orchards and gardens near houses than in the deep woods. It is a large, elaborately built affair, constructed first of a thick layer of straws, weeds, roots, and mosses; on this is built the nest proper, which is made of straws and weeds, woven together in a circular form and plastered together with mud; this is lined with soft grasses and moss, the whole making a durable structure, often holding together through the entire year. The eggs are usually four in number; their color is a beautiful greenish blue, almost the same as that of the wood thrush's egg, which they resemble in shape, except they are a trifle broader. Dimensions of a nest complement of four eggs, 1.16 by .82 inch; 1.16 by .82 inch; 1.10 by .75 inch; 1.10 by .80 inch. Many cases occur in the southern districts of New England of two broods being reared in the season, and I have known of three broods being reared in Massachusetts; but in the northern districts I think that the second brood is the exception instead of the rule.

BROWN THRUSH—BROWN THRASHER, MAVIS, (*Harporhynchusr ufus.*)—Cab

Probably none of our summer visitors are better known, and none are greater favorites than this bird. Its beautiful song and well-known beneficial habits have endeared it to the farmer, who takes it under his protection, as he should all the thrushes, and encourages its approach to the garden and orchard. The brown thrush arrives from the south about the middle of April in Connecti

cut and Rhode Island, and the 10th of May in Maine and the other northern districts. The birds seem to be mated before their arrival here, as they are almost always observed in pairs at their first appearance. The nest is built about the middle of May, sooner or later, according to latitude. It is usually placed in a bush or thicket of briers or vines, sometimes on the ground at the foot of a clump of bushes. It is composed, first of a layer of twigs, then leaves and straps of cedar and grape-vine bark, and the whole is covered with fibrous roots; the nest is pretty deeply hollowed, and lined with fine roots and hairs. The eggs are from three to five in number; their color is a greenish or dirty white, over which are thickly sprinkled minute dots of reddish brown; their shape is ovate, and their dimensions vary from 1.16 by .80 inch to 1.06 by .76 inch. A great number before me exhibit these variations, which probably are the greatest of this species, as the eggs are generally nearly of a size. Four eggs in a nest collected in New Hampshire, have the following measurements: 1.12 by .78 inch; 1.12 by .76 inch; 1.08 by .76 inch; 1.06 by .76 inch. But one brood is reared in the season in the northern States.

CAT BIRD, (*Mimus* Carolinensis.*)—Gray.

This very common and well-known species arrives in New England from the south from about the first week in May to the fifteenth of that month; it is very generally distributed through these States, and its habits are too well known to require much mention here. Soon after mating the birds build; this is from about the 20th of May to the first week in June. The nest is usually built in bushes and shrubs, seldom more than four or five feet from the ground; the location as often in the deep woods as in the fields or pastures. It is constructed, first of a layer of twigs and sticks, on which is built the body of the nest, which is composed of strips of grape-vine bark, fine twigs, leaves, and straws; it is deeply hollowed and lined with fibrous roots and hairs, and sometimes fine grass. The eggs are usually four in number, sometimes five; their color is a bright, deep emerald green, and their form generally ovate. A great number of specimens before me do not exhibit great variations in measurement from the dimensions of a nest complement of four collected in Thornton, New Hampshire; they are as follows: .95 by .67 inch; .95 by .66 inch; .93 by .67 inch; .93 by .66 inch. Two broods are reared in the season, seldom three in this latitude.

BLUE BIRD, (*Sialia sialis.*)—Baird.

This beautiful bird is a very common summer inhabitant of all New England. It is one of the earliest in its arrival from the south, often making its appearance by the middle of March, sometimes even earlier. About the middle of April, immediately after pairing, the birds commence preparing their nests; this is made in a deserted woodpecker's hole, in a martin's box, or in a knot-hole in a fence post. The materials used in its construction are generally soft grasses, feathers, and wools; these are thrown together without any great care, the object being to get comfort and warmth in the early season in which the first litter of eggs is laid. The eggs are either four or five in number; they are of a light blue color, with a very faint greenish tint. Five specimens, taken at random from a great number, exhibit the following measurements: .86 by 62 inch; .85 by .62 inch; .84 by .61 inch; .82 by .60 inch; .80 by .60 inch. This species raises two broods, usually in the same nest, in the

* Professor Spencer F. Baird, one of the first naturalists in the country, in a recent review of American birds, has placed this species in the genus Galeoscoptes of Cabanis; as the change is based on technical characteristics not essential to the present paper, I have retained the original name, mimus.

season. The same remarks will apply to this bird as to the thrushes as regards utility; it destroys immense numbers of noxious insects, and is every way worthy the protection of the farmer.

BLACK AND WHITE CREEPER, (*Mniotilta varia.*)—Vieillot.

This rather common species is a summer inhabitant of all New England. It arrives from the south often as early as the first week in April, always by the 20th, and soon pairs, and commences building. Audubon says, that "in Louisiana its nest is usually placed in some small hole in a tree, and is composed of mosses in a dry state and lined with cottony substances." The nest of this bird in New England is almost always built or rather placed on the ground; the situation chosen is almost always beneath an overhanging point of rock, or beneath a fallen trunk of a tree; it is made of mosses, straw, leaves, and other soft materials, and is lined with cotton from ferns, soft grass, or hair. The eggs are laid by the middle of May; they are usually four or five in number; their color is white, with a slight cream tinge, and they are spotted irregularly with fine dots and confluent blotches of reddish brown, thickest near the largest end of the egg. Dimensions of four eggs found in a nest in Reading, Massachusetts: .66 by .54 inch; .66 by .54 inch; .65 by .54 inch; .65 by .54 inch. Two broods are occasionally reared by this species in southern New England.

BLUE YELLOW-BACKED WARBLER, (*Parula Americana.*)—Bonap.

This species, I am inclined to think, is not common in any part of New England, although it undoubtedly breeds in all the three northern of these States. It arrives from the south about the middle of May, sometimes a little earlier. The birds, on their arrival, seem to be mated, for they are almost always seen in pairs, often two males with one female. About the first of June the birds commence building their nest; this is placed in a fork near the end of a branch of a tree, about twenty feet from the ground. It is usually constructed of the long, gray Spanish moss that is so plentiful in the States of Maine, New Hampshire, and Vermont. A beautiful specimen in my collection, collected in Maine by John Krider, of Philadelphia, who kindly presented it to me, is of this description, and one of the most curious specimens of bird architecture; the long hairs of the moss are woven and twined together in a large mass, on one side of which is the entrance to the nest, a mere hole left in the moss; the lining is nothing but the same material, only of a finer quality. There is another nest of this species in the collection of the Museum of Comparative Zoology in Cambridge, which was also found in Maine. The eggs are usually four in number, and they are laid about the first week in June. Their color is white, with a very slight creamy tint, and covered more or less thickly with spots and confluent blotches of brownish red and obscure lilac, thickest at the large end. Two eggs in my collection are of the following measurement: .62 by .48 inch and .63 by .46 inch.

MARYLAND YELLOW-THROAT, (*Geothlypis trichas.*)—Cabanis.

This bird is a common inhabitant of all the New England States. It arrives from the south about the second week in May, sometimes earlier, and soon commences building. The nest is usually built on the ground, although often in thickets of briers and bushes. It is constructed of leaves and grasses, and is lined with fine grasses and hairs. It is often built over at the top, with the entrance through a hole in the side. The whole makes a bulky affair, almost impervious to water.* The eggs are laid about the last week in May or first week

* A nest sent me from Delaware is constructed of grasses, which are woven into a loose fabric, quite different from northern specimens.

in June. They are variable in size and markings, but are usually five in number. To illustrate the difference in size and markings, I will describe five eggs found in a nest in Milton, Mass.: No. 1 is creamy white in color, with numerous spots of dark brown and obscure spots of lilac; these markings are thinly scattered over the eggs, but are quite thick at the larger end; dimensions, .70 by .52 inch. No. 2 has the same ground color, but the markings consist of numerous spots and confluent blotches of light brown and lilac at the large end of the egg; dimensions, .70 by .56 inch. No 3 is pure white, with thinly scattered spots of brown and black running like a ring around the larger end of the egg; dimensions, .74 by .50 inch. No. 4 is of a pure white color, with thinly scattered spots of light brown around the larger end; dimensions, .66 by .52 inch. No. 5, of the same color, size, and markings as No. 4. Other eggs of this species in my collection exhibit other markings from spots and blotches of lilac and brown at the larger end to thinly scattered dots of reddish over the entire surface; and one specimen has numerous irregular lines in a circle around the larger end of the egg. This species rears two broods in southern New England in the season. I have found nests often as late as the middle of July. The habits of the Maryland yellow throat are well known. He is first noticed in the swampy thickets, darting in and out through the tangled shrubbery. Soon he makes his appearance in the flower garden and orchard, where he may be seen at almost all times through the breeding season busily engaged searching for his insect food; occasionally pausing to carol his pretty song, then darting away for a discovered insect, then caressing his mate or flying to his nest with food for his young.

Yellow-breasted Chat, (*Icteria viridis.*)—Bonap.

This bird is extremely rare in New England, and Massachusetts seems to be its northern limit; in this State it occasionally breeds, and it will, probably, gradually become more plenty. I have never met with the nest of this bird, and shall have to borrow Nuttall's description:

"Soon after their arrival the icterias begin to build, fixing the nest commonly in a bramble bush, in an interlaced thicket, a vine, or small cedar, four or five feet from the ground. The outside is usually composed of dry leaves, or thin strips of grape-vine bark, and with root fibres and dry, slender blades of grass. The eggs are about four, pale flesh-colored, spotted all over with brown or dull red. The young are hatched in the short period of 12 days, and leave the nest about the second week in June."

Four eggs in my collection exhibit the following dimensions: .71 by .60 inch, .70 by .60 inch, .68 by .59 inch, .67 by .58 inch.

Nashville Warbler, (*Helminthophaga ruficapilla.*)—Cabanis.

This species is quite common in the spring migrations, but few breed in the southern districts of New England. I saw a number in the northern part of Maine and New Hampshire as late as the 20th of June, and probably the great bulk of them breed in that latitude. A nest collected in Medford, Massachusetts, by H. A. Purdie, esq., containing three eggs, is all that I have accessible at present. The nest was sunken somewhat in the ground, and is constructed of the leaves of the pine, which are very neatly woven into a compact, circular fabric, deeply hollowed, and lined with horse-hair and fine leaves of the pine; the eggs are of a white color, with a very faint rosy tint, and covered irregularly with dots of reddish brown and obscure lilac; dimensions of the three specimens: .61 by .50 inch, .60 by .48 inch, .58 by .48 inch. J. A. Allen, in his Catalogue of the Birds of Springfield, Massachusetts, gives the following exceedingly interesting description of the nest and eggs of this bird:

"I have found the nest of this species for two successive seasons as follows: May 31, 1862, containing four freshly-laid eggs. The nest was placed on the ground, and sunken so

that the top of the nest was level with the surface of the ground, and protected and completely concealed above by the dead grass and weeds of the previous year. It was composed of fine rootlets and dry grass, lined with fine, dry grass and a few horse-hairs, and covered exteriorly with a species of fine, green moss. The eggs were white, sprinkled with light reddish brown specks, most thickly near the larger end. Longer diameter sixty, and the shorter fifty one-hundredths inch. The following year, June 5, 1863, I found another nest of this species, within three or four feet of where the one was discovered the previous year, and containing three eggs of this species, and one of the cow bunting, in all of which the embryos were far advanced. The nest, in every particular, was built and arranged like the one above described, and the eggs must have been laid at just about the same season. In both cases the female bird was secured, and the identity ascertained beyond question. The locality of the nests was a mossy bank, at the edge of young woods, sloping southward, and covered with bushes and coarser plants."

GOLDEN-CROWNED THRUSH—OVEN BIRD, (*Seiurus aurocapillus.*)—Swainson.

This beautiful and well-known bird is a common summer inhabitant of New England, breeding abundantly in all the States. It arrives from the south about the last week in April or first in May, and soon commences building. The birds are not often paired on their arrival, and many are the little quarrels and battles that occur between two or three males for the possession of one of the opposite sex. The birds both work diligently in the construction of the nest, which is a model of neatness and ingenuity. It is built on the ground in the woods, usually in a dry situation; the materials used are dry leaves and grasses; these are arranged compactly together, and built over at the top, the entrance being on the side, like an old-fashioned oven, hence the familiar name of the "oven bird." The nest is usually placed in a slight hollow in the earth, scratched by the birds, and is lined with soft grasses and hairs. The eggs are from three to five in number, usually four. They are of a delicate creamy white color, and spotted irregularly with different shades of reddish brown, and some specimens have a number of spots of obscure lilac color. The markings are usually thickest at the larger end of the egg, where they are often confluent, and cover the primary color. Dimensions of four specimens collected in a nest in West Roxbury, Massachusetts: .80 by .64 inch, .79 by .64 inch, .79 by .62 inch, .78 by .62 inch. A great number of specimens, collected in different localities of New England, show no great variations from these measurements.

WATER THRUSH, (*Seiurus noveboracensis.*)—Nuttall.

This is a rare summer inhabitant of New England. It breeds in Maine, New Hampshire, and Vermont, and probably in Massachusetts, as I have seen the birds throughout the summer. I have never been so fortunate as to find the nest of this species, and must avail myself of the observations of others. Mr. Verrill says, in his paper on Maine birds, before referred to:

"A nest found, June 8, 1861, in a dense cedar swamp, was built in an excavation in the side of a decayed, moss-covered log, so that the excavation itself formed an arch over the nest, instead of one made by the bird, as in the preceding species. The nest was constructed of moss, and lined with fine roots. The five eggs were of a delicate flesh color, spotted with light reddish brown."

Nuttall says of the nest:

"It is placed usually at the foot of a tree, or by the side of a decayed log, and is formed of dry leaves, moss, and fine grass, being lined with hair or the similar fibres of the Spanish moss, (*Tilandsia.*) The eggs are four or five, flesh-colored, with dark spots at the greater end."

BLACK-THROATED GREEN WARBLER, (*Dendroica virens.*)—Baird.

This beautiful bird is a quite common species in Rhode Island, Connecticut, and Massachusetts, and is not rare in the other New England States, in which, I have no doubt, it breeds, though not near so abundantly as in those first men-

tioned. It arrives from the south from about the 25th of April to the 1st of May, in Massachusetts. I have often seen this species as late as the last week in May busily engaged in destroying insects, (of which its food, as also that of the other warblers, consists,) apparently without being mated, as several individuals of both sexes were together, seemingly in harmony, but without those little fondlings and attentions peculiar to mated birds. The nest is seldom built before the 10th of June in this latitude. It is constructed of fine grasses, fibrous roots, fine strips of bark from the cedar, and the leaves of the pine; these are entwined together neatly, and the interior of the nest is lined with horse hair and fine moss. Nuttall, in describing the only nest of this bird that he ever saw, says:

"On the 8th of June I was so fortunate as to find a nest of this species in a perfectly solitary situation, on the Blue Hills of Milton, Massachusetts. The female was now sitting, and about to hatch. The nest was in a low, thick, and stunted Virginia juniper. When I approached near the nest the female stood motionless on its edge, and peeped down in such a manner that I imagined her to be a young bird; she then darted directly to the earth, and ran; but when, deceived, I sought her on the ground, she had very expertly disappeared, and I now found the nest to contain four roundish eggs, white, inclining to flesh color, variegated, more particularly at the great end, with pale, purplish points of various sizes, interspersed with other large spots of brown and blackish. The nest was formed of circularly entwined fine strips of the inner bark of the juniper, and the tough, fibrous bark of some other plant, then bedded with soft feathers of the robin, and lined with a few horse-hairs, and some slender tops of bent grass (*Agrostis*.")

Early in June, 1863, a nest of this species was discovered in a grove of pines in West Roxbury; it was built in a small fork of a pine, about ten feet from the ground. The nest and its contents, four eggs, were removed, but the birds remained in the neighborhood, and soon commenced building another nest in the same tree, but a few feet higher; in it the female laid three eggs, after which this nest and eggs were removed; but soon after they built another nest in another pine, near the first; this nest was perhaps twenty-five feet from the ground; in this two eggs were laid, which were allowed to be hatched. One of these nests, with four eggs, is in my collection, and is already described above. The eggs are a pale, creamy, white color, with a very faint roseate tint, and are marked with coarse and fine spots of brown of different shades, and obscure spots of lilac. These markings are quite thick at the large end of the egg, in fact, are almost confluent into a sort of girdle. Their dimensions are .66 by .53 inch, .66 by .52 inch, .64 by .52 inch, and .62 by .51 inch.

Yellow-rump Warbler—Myrtle Bird, (*Dendroica coronata*,) Gray.

This species is quite abundant in spring and fall throughout New England, but very few breed in these States. I have met with but one nest in Massachusetts, and have heard of but two or three others. This nest was built in a low barberry bush in Waltham; it was constructed of fine grasses and the down from ferns. These materials were carefully woven together into a neat fabric, which was lined with cottony substances and a few horse-hairs. The eggs were three in number; these were of a creamy white color, covered sparsely with spots and blotches of different shades of brown, thickest at the large end of the egg. Dimensions of the eggs .68 by .50 inch; .67 by .50 inch; .66 by .49 inch. Audubon describes a nest and eggs sent him from Nova Scotia as follows:

"It resembles that of the *Sylvia æstiva* of Latham, being firm, compact, the outer parts formed of silky fibres from different plants, attached to the twigs near it by means of glutinous matter, mixed with the inner bark of some tree unknown to me. Within this is a deep and warm bed of thistle down, and the inner layer consists of feathers and the fine hair of small quadrupeds.

"The eggs are rather large, of a light rosy tint, the shell thin and transparent; they are sparingly dotted with reddish brown near the larger end, but in a circular manner, so that the extremity is unspotted."

PINE-CREEPING WARBLER, (*Dendroica pinus.*)—Baird.

This bird, although quite common in all New England in the spring migration, rarely breeds in these States, but further to the north. It arrives from the south very early, often before the last snow-storm of the season, and remains in the deep swamps of hemlocks or pines until the weather opens; about the first week in May the birds become scarce, and soon but very few can be found. A nest with two eggs, found in Woburn, Massachusetts, and another nest with three eggs, from West Roxbury, in the same State, are all the specimens accessible to me at the present time. These nests were built in forks of pine trees, about twenty feet from the ground. They are constructed of the bark of the cedar and leaves of the pine; these materials are entwined into a neat structure, which is warmly lined with mosses and hairs of different animals. The eggs are of a bluish-white color, with a slight roseate tint; this primary color is dotted with spots of two shades of brown and reddish, and some spots of purple. Dimensions vary from .69 by .50 inch, to .67 by .51 inch.

CHESTNUT-SIDED WARBLER, (*Dendroica Pennsylvanica.*)—Baird.

This bird is a rather common summer inhabitant of all New England, most plentiful in Massachusetts and the States south, and gradually growing more rare as we advance north. It makes its appearance from the south about the first to the middle of May, according to latitude, and commences to build about the last week in this month or the first in June. The nest is usually built in a small fork of a low tree, often in bushes, but a few feet from the ground. It is constructed of thin strips of pliable bark and fine grasses; these materials are bent and entwined together, and over the outside are pieces of caterpillar silk and cobwebs, which are plastered on, seemingly, to give the fabric compactness and consistency; the nest is deeply hollowed, and lined with horse-hairs and slender strips of the bark of the grape-vine. Nuttall describes a nest found in Acton, Massachusetts, as follows:

"It is fixed in the forked twigs of a hazel, about breast-high. The fabric is rather light and airy, being made externally of a few coarse blades and stalks of dead grass, then filled in with fine blades of the same, the whole matted and tied with caterpillars' silk, and lined with very slender strips of brown bark and similar white-pine leaves."

The nests I have collected, and some I have before me, are of a different character from his description, being compactly and neatly made of bark from the cedar, and grasses, and lined with horse-hair; but I have no doubt that this species, as do many others, varies in breeding habits in different localities. The eggs are three or four in number, and are laid about the first week in June. They are of a delicate creamy-white color, and marked at the great end with spots of brown, which are often confluent; the spots are of two colors, a reddish brown and purplish brown. The dimensions vary from .70 by .51 inch to .63 by .50 inch. But one brood is raised in this latitude.

YELLOW WARBLER—SUMMER YELLOW BIRD, (*Dendroica æstiva.*)—Baird.

This exceedingly abundant species is a summer resident, and breeds in all the New England States. It arrives from the south about the last of April or first of May, and commences building about the 15th of the latter month. The nest is usually built in a low bush, frequently the barberry; occasionally it is placed in an alder or maple tree, seldom more than fifteen or twenty feet from the ground, although Mr. Nuttall gives instances of its being built in the forks of a sugar-maple tree, fifty feet from the ground; this is a very rare case, however. I think Nuttall's description of the nest the best I have seen, and give it entire:

"The nest is extremely neat and durable; the exterior is formed of layers of *asclepias*, or silk-weed lint, glutinously though slightly attached to the supporting twigs, mixed with

some slender strips of fine bark and pine leaves, and thickly bedded with the down of willows, the nankeen wool of the Virginia cotton-grass, (*Eriophorum virginicum,*) the down of fine stalks, the hair of the downy seeds of the button-wood, (*Platanus,*) or the papus of compound flowers, and then lined either with fine bent grass, (*Agrostis,*) or down, and horse-hair, and rarely with a few accidental feathers."

The eggs are usually four in number, sometimes five; they vary in color from creamy white, with numerous spots and blotches of different shades of brown, to a grayish white, with a greenish tint, and marked with the same spots and blotches; these markings are thickest at the larger end of the egg, where they are often confluent. Dimensions vary from .67 by .50 inch to .64 by .50 inch. The habits of this bird are well known, and its genial nature and confiding dispoitions have rendered it a great favorite with the farmer.

Black-poll Warbler, (*Dendroica striata.*)—Baird.

This bird, although very abundant in all parts of New England in the spring migrations, passes far to the north to breed; but few remain in the States through the breeding season, and these in the most northern districts. It arrives from the south about the middle of May and proceeds leisurely on its journey, arriving at its destination about the first week in June. I have two nests in my collection, both found in the northern part of Maine; they were placed in low trees or saplings, and are constructed of, first, a layer of twigs and grass, then the leaves of the pine and moss; these materials are twined into a compact structure, somewhat bulky, and deeply hollowed, and lined with feathers of wild birds and hairs of different animals. I have but two eggs of this species; these were collected in Aroostook county, Maine; they are of a grayish-white color, thickly marked with spots and blotches of two or three shades of brown and purple. Dimensions, .70 by .52 inch; .67 by .50 inch. Audubon describes the only nest of this bird that he ever met with, as follows:

"It was placed about three feet from the ground, in the fork of a small branch, close to the main stem of a fir-tree. Its diameter internally was two inches, the depth one and a half; externally it resembled the nest of a white-crowned sparrow, being formed of green and white moss and lichens, intermixed with coarse dried grass; within this was a layer of bent grass, and the lining was of very dark-colored, dry moss, looking precisely like horse-hair, arranged in a circular direction with great care. Lastly, there was a thick bed of large soft feathers, some of which were from ducks, but most of them from willow-grouse."

The same author describes the habits of this bird as follows:

"You see it darting in all directions after insects, chasing them on the wing, and not unfrequently snapping, so as to emit the clicking sound characteristic of the true fly-catcher. Its activity is pleasing, but its notes have no title to be called a song. They are shrill, and resemble the noise made by striking two small pebbles together, more than any other sound I know."

Prairie Warbler, (*Dendroica discolor.*)—Baird.

This is a rather rare species north of Massachusetts, which State seems to be its northern breeding limit. It makes its appearance about the first week in May, and commences building about the 20th of that month. I have been so fortunate as to find two nests in Norfolk county, and have had another nest and eggs sent me from Belmont, in this State; I have also known of several other nests being found, and judge that the species breeds rather abundantly in Massachusetts and the other two southern New England States. These nests were all placed in low barberry bushes, in rocky localities. They are exceedingly neat structures, the most so of any of our New England warblers' nests; they are constructed of various soft cottony substances, after the manner of the nest of the yellow warbler, and are lined with soft feathers and wool. The eggs are usually three in number; these are of a beautiful pearly-white color, with a slight roseate tint, and covered irregularly with small spots of different shades of brown and lilac, thickest at the large end. Dimensions of three eggs collected

in Belmont, Massachusetts, .64 by .52 inch; .63 by .52 inch; .60 by .50 inch. The above-described nests were invariably placed in the fork of the bush in which they were built; the materials were the same, consisting of the down from different plants, cotton, wool, and other like substances. I find, on referring to Audubon, Wilson, and others, considerable differences in the description of the nest, &c. Wilson's description is as follows:

"The nest of this species is of very neat and delicate workmanship, being pensile, and generally hung on the fork of a low bush or thicket; it is formed, outwardly, of green moss, intermixed with rotten bits of wood and caterpillars' silk; the inside is lined with extremely fine fibres of grape-vine bark; and the whole would scarcely weigh a quarter of an ounce."

Audubon says:

"Its nest, which forms by far the most interesting part of its history, is uncommonly small and delicate. Its eggs I have uniformly found to be four in number, and of a white color, with a few brownish spots near the larger end. The nest is sometimes attached to three or four blades of tall grass, or hangs between two small sprigs of a slender twig. At first sight it seems to be formed like that of the humming-bird, the external parts being composed of delicate gray lichens and other substances, and skins of black caterpillars, and the interior finished with the finest fibres of dried vines."

Nuttall says, in contradiction to these descriptions:

"The nest was hardly distinguishable from that of the summer yellow bird, (yellow warbler,) being fixed in a trifid branch, (not pensile,) and formed of strips of inner red-cedar bark and *asclepias* fibres, also with some caterpillar silk, and thickly lined with cud-weed down, (*Gnaphalium plantagineum,*) and slender tops of bent grass, (*Agrostis.*) The eggs, four or five, were white, rather sharp at the lesser end, marked with spots of lilac-purple, and others of two different shades of brown, rather numerous at the great end, where they appear most collated together in a circle."

Nuttall's description of the nest is certainly the most correct, so far as all the specimens that I have seen went; probably in different sections the breeding habits of this bird are, like those of some others, subject to great variations.

RED START, (*Setophaga ruticilla.*)—Swainson.

This quite common species is a summer resident, and breeds in all the New England States. It arrives from the south from about the first to the middle of May, according to latitude, and commences building about the first week in June. The nest is placed, usually, on a low limb of a small tree; often in a horizontal fork, seldom more than ten feet from the ground. It is constructed of strips of cedar bark, grape-vine bark, grasses, and fine weeds; these materials are adjusted neatly, and agglutinated by the bird's saliva into a compact structure, to the exterior of which are attached, or plastered on by the birds' saliva, fragments of soft lichens, caterpillars' silk, and down from the ferns; it is deeply hollowed, and lined with thin strips of grape-vine bark and cottony substances, and sometimes a few hairs of fibrous roots. Nuttall, in describing the nest, says "the lining is neither soft nor downy;" but Wilson and Audubon both assert to the contrary. I have examined a great number of the nests, and have found them to agree with the above description. The eggs are usually four in number. Their color is a beautiful creamy white, which is covered, more or less thickly, with spots of reddish brown and lilac. Average dimensions of eggs about .63 by .50 inch.

SCARLET TANAGER, (*Pyranga rubra.*)—Vieillot.

This gaudy summer visitor breeds in all the New England States, less plentifully, however, in the northern than in the southern districts. It arrives from the south about the first week in May, and commences building about the 20th of that month. The favorite localities of this bird seem to be oak groves, situated near swamps; here I have often heard several males singing at the same time, and have watched them in their active movements in their pursuit of insects,

of which this species destroys great numbers. The nest is placed on a horizontal limb of a tree, usually from fifteen to twenty feet from the ground, in the deep woods. It is constructed of slender twigs of the oak, huckleberry or whortleberry bush, and weeds; these are loosely put together; so much so, that were it not for the interlacing of the small joints of the twigs it would soon fall apart. It is not deeply hollowed, and is lined with thread-like fibrous roots and the leaves of the various pines. The whole structure is so thinly made as to almost fall to pieces on removal from the tree. The eggs are usually four in number, sometimes three, seldom five. They are of a dull light greenish-blue color, of different shades, and spattered with purplish brown, in some specimens quite thickly, in others less so. The ground color is the most prominent, the markings never completely hiding it, or sufficiently confluent to be called blotches. A nest complement of four eggs, in a nest collected in Milton, Massachusetts, exhibit the following measurements: .97 by .66 inch; .93 by .65 inch; .90 by .62 inch; .88 by .64 inch. Other specimens show no great variations from these dimensions.

BARN SWALLOW, (*Hirundo horreorum.*)—Barton.

This well-known summer visitor is found plentifully, and breeds in all New England States. It arrives about the 10th of April to the 1st of May, and soon commences building or repairing the nest of the preceding year or years, as the same nest is occupied several seasons. It is built in the eaves of houses or barns, or on rafters of barns and other buildings. It is constructed outwardly of a strong shell of pellets of mud, which are plastered together, and, as Nuttall says, "tempered with fine hay, and rendered more adhesive by the glutinous saliva of the bird." This nest is built out and up until the top is about horizontal, and then lined with a layer of fine grass or hay, which is covered over with loose feathers. This bird is fond of society, often as many as twenty nests being in the same eaves. The eggs are usually four in number, sometimes five; they are of a nearly pure white color, with a slight roseate tint, and are spotted more or less thickly with fine dots of two shades of brown, reddish and purplish, The dimensions of four eggs, collected in Upton, Maine, are .76 by .56 inch; .70 by .52 inch; .76 by .52 inch; .69 by .53 inch. The largest specimen, in a great number, is .78 by .57 inch; the smallest, .67 by .50 inch. Two broods, and sometimes three, are reared in the season. The period of incubation is thirteen days.

CLIFF SWALLOW—EAVE SWALLOW, (*Hirundo lunifrons.*)—Say.

This very generally distributed species is a common summer inhabitant of New England. It arrives from the south from about the 25th of April to the 1st of May, and soon commences building. The nest is usually built beneath eaves, or cornices, or other jutting portions of buildings, or on cliffs, beneath overhanging portions of rock; it is constructed externally of pellets of mud and earth, which are gradually plastered together into a large gourd-shaped structure, the larger part attached to the building or cliff, and the neck curving outward and downward. At the part of the nest resembling the neck of the gourd is the entrance. The whole fabric is much more brittle than the nest of the barn swallow, for the reason that no grass or hay is worked into the mud to give it strength. The eggs are usually five in number. They can hardly be distinguished from those of the preceding species, and, in fact, identification is next to impossible. In a majority of the present species the spots are somewhat coarser, and the eggs are longer. Four eggs, collected in Dorchester, Massachusetts, are of the average dimensions of .84 by .54 inch; other specimens, from various localities, are about of this size.

STUMP SWALLOW—WHITE-BELLIED SWALLOW, (*Hirundo bicolor.*)—Vieillot.

This very common and well-known species is a summer inhabitant of all New England. Its habits are well known, and arriving, as it does, early in the season, and fraternizing with man, it is a great favorite. It makes its appearance often as early as the 17th of April, but does not commence building before the middle of May. Near cities and towns the nest is built in martin boxes, provided for its reception, but in less thickly settled districts it is built in holes in stumps and trees, and cases are on record of its being built in a deserted nest of the common barn swallow. When passing through the Umbagog lakes, in Maine, I observed great numbers of these birds whose nests were built in dead trees standing in the lake near the shores. These nests are so plenty that, in the area of about ten rods square, I counted over fifty; of course, the birds were in myriads, and the species constitute the common swallow of the districts in that latitude. The materials used in the construction of the nest are fine grasses, hay and feathers; these are adjusted loosely in the cavity of the tree, and without any form. The eggs are, most commonly, five in number; their color is a beautiful clear white, with a roseate tint before their contents are removed; they are extremely thin and fragile, much more so than most of the other species, and their form is a slender oval. Of a great number of specimens, collected in various localities, the largest is .79 by .56 inch; the smallest, .69 by .51 inch. Two broods are generally reared in the season, and the period of incubation is fourteen days.

BANK SWALLOW, (*Cotyle riparia.*)—Boie.

This bird is abundantly distributed as a summer inhabitant throughout all New England. It arrives the first week in May, often earlier, and soon pairs and commences building, or rather excavating for the nest. The excavations are made in sand-banks, in the same manner as those of the kingfisher, and are often three or four feet in depth, usually about eighteen inches; at the end of this burrow, which is widened and enlarged, is placed the nest, composed of dried grasses, hay, feathers, and other like soft materials. The birds are sociable in their habits, as are all the other preceding species, and often as many as twenty or thirty holes may be seen in the same bank. The number of eggs is either five or four; these are of a pure white color, and vary but little in size or shape, the latter being almost always oval, and the size ranging from .72 by .52 inch to .68 by .49 inch. Usually two broods are reared in the season, but often only one.

MARTIN—PURPLE MARTIN, (*Progne purpurea.*)—Boie.

This species, although distributed generally throughout New England as a summer inhabitant, is less abundant than any other of its family. It arrives from the south from about the tenth to the last of April, according to latitude, and soon commences building. The nest is usually built in a martin's box, placed for its reception, a blue bird's hole, or, sometimes, a hole in a tree. Usually this bird prefers the neighborhood of a dwelling-house for its home, and, unlike all the other species, is not sociable in its habits, seldom more than two pairs residing in one neighborhood.

The nest is composed of dried grasses, feathers, &c., and is occupied for several seasons. The eggs are from four to six in number, of a pure white color, and vary but little in form from exactly oval; four specimens collected in Connecticut exhibit the following measurements: 1.04 by .70 inch; 1 by .70 inch; 1 by .68 inch; .97 by .68 inch. Other specimens vary but little from these dimensions. Two broods are often reared in the season, and the period of incubation is fourteen days.

In dismissing this family, it is hardly necessary, at this late day, to say a word in favor of their beneficial habits, for every farmer has recognized them and encouraged the presence of the birds, and protected them for years. But the immense amount of injurious and noxious insects they destroy is astonishing, and hardly realized, amounting probably to several hundreds by every bird in the day.

CEDAR BIRD—CHERRY BIRD, (*Ampelis cedrorum.*)—Baird.

This very common and well-known bird is a summer inhabitant of all New England. It remains in the southern districts through the winter, but usually arrives, in flocks of twenty or thirty, as early as the first or second week in March. About the middle of May these flocks are divided into smaller ones, and these soon into pairs, which commence building about the last week in May or first in June. The nest is placed in the midst of twigs on a horizontal branch, generally of a tree in the orchard; sometimes in a cedar or other tree in a pasture or wood. It is constructed of stalks of weeds, long fine roots, grass, grape-vine bark, and leaves; it is deeply hollowed, and lined with fine roots, horse-hairs, and fine grass. One specimen in my collection is partly composed of strips of twine and thread, which are woven together in a very neat and compact manner, and interlaced with numerous fine roots and weeds. The eggs are usually four or five in number; they are laid about the first week in June, and a second litter often in August. They are of a light-bluish or clay-white color, with a slight purple tint, and are marked, more or less thickly, with distinct spots of black, and more obscure spots of purplish brown, the appearance of these latter spots is as if they were "beneath the surface of the shell." Dimensions of five eggs collected in New Hampshire: .86 by .64 inch; .86 by .63 inch; .86 by .60 inch; .80 by .62 inch; .80 by .60 inch. A great number of specimens from different localities do not exhibit any great variations from these measurements.

There is a great deal of ill feeling manifested towards this well-known bird by the farmers, on account of its occasionally helping itself to a few cherries or other small fruits. Its valuable services in the orchard and nursery seem to be overlooked, and its life is often forfeited for this little weakness! But if the farmer will observe it in its insect-destroying labors, watch it as it devours caterpillar after caterpillar, or draws from its lurking place the larva of some injurious insect, he will come to the conclusion, as many have already done, that this bird is worthy his protection, instead of deserving his anger.

SHRIKE—BUTCHER BIRD, (*Collyrio borealis.*)—Baird.

This bird, although a not uncommon winter visitor, seldom breeds within the limits of New England, and when it does, only in the most northern districts, in the deep forests. I have never met with the nest in New England, and will borrow Audubon's description:

"About the 20th of April the male and his mate are seen engaged in building their nest in the covered and secluded parts of the forests. I found several of their nests placed on bushes not above ten feet from the ground, without any appearance of choice as to the tree, but generally towards the top, and placed in a fork. The nest is as large as that of the robin, and is composed externally of coarse grasses, leaves, and moss; internally of fibrous roots, over which is a bed of the feathers of the wild turkey and pheasant, (*Tetrao umbellus.*") Nuttal, in describing the nest, says that it is "large and compact, in the fork of a small tree, and sometimes in an apple tree, composed externally of dried grass, with whitish moss, and well lined with feathers."

The eggs are from four to six in number, of a dirty lead-colored white, and marked more or less thickly around the greater end with dashes and spots of brown of different shades. Dimensions of four eggs collected in New Brunswick: 1.12 by .80; 1.12 by .78 inch; 1.08 by .78 inch; 1.04 by .77 inch.

RED-EYED VIREO—RED-EYED FLYCATCHER, (*Vireo olivaceous.*)—Vieile.

This favorite summer visitor breeds abundantly in all the New England States. It arrives from the south from about the first week to the middle of May, and commences building about the first week in June, frequenting the woods rather more commonly than the pastures and orchards, although it often breeds in these places. The nest is pensile, and is hung from the fork of a small limb of a tree, seldom more than fifteen or twenty feet from the ground; it is constructed of thin strips of cedar bark, pieces of wasps' nests, spiders' nests, pieces of caterpillars' silk, and other pliable materials. These are woven together neatly and compactly, and agglutinated together by the bird's saliva. It is suspended in the form of a basket from the forked twig to which it is attached, or rather sewed firmly. It is lined with narrow strips of grape-vine bark, pine leaves, and sometimes fine grass. On the outside are often visible bits of rotten wood, fragments of newspaper, and hornet's nest. One specimen in my collection, obtained in Maine, is constructed almost entirely of pieces of the bark of the white birch; it is a very neat fabric. The eggs are four in number, pure white in color, and thinly spotted, chiefly at the great end, with dots of brownish black. The measurement of four eggs in a nest collected in Milton, Massachusetts, are: .84 by .60 inch; .80 by .60 inch; .80 by .59 inch; .78 by .59 inch. Other specimens vary but little from these dimensions. Two broods are often reared in the season. The period of incubation is twelve days.

WARBLING VIREO—WARBLING FLYCATCHER, (*Vireo gilvus.*)—Bonap.

This bird is a not very common summer inhabitant of New England, although it is not by any means rare. It arrives usually in pairs about the first week in May, and commences building about the middle of the month. The nest is pensile, and usually built in tall trees, often fifty feet from the ground. It is constructed of strips of grape-vine bark, grass, leaves, or bass-wood bark, and sometimes bunches of caterpillars' silk are left on the outside, as if for ornament. The following very interesting account of the breeding habits of this bird is given by Audubon, who watched a pair building in a Lombardy poplar:

"One morning I observed both of them at work; they had already attached some slender blades of grass to the knots of the branch and the bark of the trunk, and had given them a circular disposition. They continued working downwards and outwards until the structure exhibited the form of their delicate tenement. Before the end of the second day bits of hornets' nests and particles of corn husks had been attached to it by pushing them between the rows of grass, and fixing them with silky substances. On the third day the birds were absent, nor could I hear them anywhere in the neighborhood, and thinking that a cat might have caught them from the edge of the roof, I despaired of seeing them again. On the fourth morning, however, their notes attracted my attention before I arose, and I had the pleasure of finding them at their labors. The materials which they now used consisted chiefly of extremely slender grasses, which the birds worked in a circular form within the frame which they had previously made. The little creatures were absent nearly an hour at a time, and returned together bringing the grass which, I concluded, they found at a considerable distance. Going into the street to see in what direction they went, I watched them for some time, and followed them as they flew from tree to tree towards the river. There they stopped, and looked as if carefully watching me, when they resumed their journey, and led me quite out of the village to a large meadow, where stood an old hay stack. They alighted on it, and in a few minutes each had selected a blade of grass. Returning by the same route, they moved so slowly from one tree to another, that my patience was severely tried. Two other days were consumed in travelling for the same kind of grass. On the seventh I saw only the female at work, using wood and horse-hair; the eighth was almost entirely spent by both in smoothing the inside. They would enter the nest, sit in it, turn round and press the lining. In the course of five days an equal number of eggs were laid; they were small, of a rather narrow oval form, white, thinly spotted with reddish black at the larger end. The birds sat alternately, though not with regularity as to time, and on the twelfth day of incubation the young came out. I observed that the male would bring insects to the female, and that after chopping and macerating them with her beak, she placed them in the mouth of her young with a care and delicacy which were not less curious than pleasing to me."

This account is so full and complete that I can add nothing to the history of the breeding habits of this bird. But one brood is reared in the season in this latitude. The dimensions of four eggs in my collection from different localities are: .83 by .56 inch; .80 by .56 inch; .78 by .54 inch; .78 by .53 inch. These will be found to be the average size of this species. The nest is about three inches in exterior diameter, and about two and a half in depth.

WHITE-EYED VIREO—WHITE-EYED FLYCATCHER, (*Vireo noveboracensis.*)—Bonap.

This species is a not common summer inhabitant of New England north of Massachusetts, where it is pretty abundant. It arrives from the south usually in pairs from about the 10th of April to the 1st of May. The birds commence building about the last week in May. The nest is usually placed in a thicket of briers or vines, often in the gardens and fields. It is constructed of fibres of the inner bark of trees, fine twigs, grasses, pieces of hornets' nests, and fragments of paper. These are built in a pensile form, suspended by the upper edge, and lined with slender strips of grape-vine bark and roots. The eggs are usually four in number, and can hardly be distinguished from those of the red-eyed vireo in shape or color, the average dimensions being a trifle smaller. Several eggs collected in different localities exhibit as an average measurement .82 by .59 inch. A nest complement of four eggs, collected in Milton, Mass., vary but a trifle from this size, their measurement being .83 by .59 inch; .82 by .59 inch; .82 by .58 inch; .80 by .58 inch. But one brood is usually reared in New England in the season, and the period of incubation is twelve days.

SOLITARY VIREO—BLUE-HEADED FLYCATCHER, (*Vireo solitarius.*)—Vieillot.

This bird is a rather rare summer visitor in New England. It makes its appearance about the first or second week in May. I have never met with its nest, and Audubon's description, though meagre, is the best available; it is as follows:

"The nest is prettily constructed, and fixed in a partially pensile manner between two twigs of a low bush on a branch running horizontally from the main stem. It is formed externally of gray lichens, slightly put together, and lined with hair, chiefly from the deer and raccoon. The female lays four or five eggs, which are white, with a strong tinge of flesh color, and sprinkled with brownish-red dots at the larger end."

I have but one egg in my collection; it corresponds in color and markings to the above description, and measures .81 by .59 inch. But one brood is reared in the season, although there have been specimens taken as late as October. But little is known of the habits of this bird, as it prefers the deep woods and swamps to the more open districts.

YELLOW-THROATED VIREO, OR FLYCATCHER, (*Vireo flavifrons.*)—Vieillot.

This beautiful vireo is not very common in New England, although it is found in all these States as a summer visitor. It arrives from the south about the middle of April, sometimes not before the first of May, and commences building about the middle of the latter month. The nest is placed in a small fork of a tree, usually the apple tree, at a height of about fifteen or twenty feet from the ground. It is the most beautiful nest made by birds of this genus; it is built of nearly the same materials as the others, but is covered in the most tasty manner with pieces of lichens and caterpillars' silk and spiders' webs, which are plastered or agglutinated on over the entire surface, giving the nest the appearance of a large bunch of moss hanging from a forked twig. Several of these nests, collected in different localities, are in my collection. They are invariably

of this description, and are all lined with pieces of paper, wasps' nests, and fine grasses. With the exception of the nest of the humming-bird, and, perhaps, two or three others, the nest of this species is the most beautiful specimen of bird architecture that I am acquainted with. The eggs are usually four in number. They are of a pure white color, with thinly scattered spots of two shades of reddish brown and black. The dimensions of four eggs collected in Connecticut are: .83 by .61 inch; .82 by .60 inch; .82 by .60 inch; .80 by .59 inch. But one brood is reared in the season in New England.

In dismissing this beautiful and favorite family of birds, I feel that it is impossible to say too much in their favor; their neat and delicate plumage and sweet song, (kept up in one species, the red-eyed vireo, until October,) their engaging and interesting habits, and their well-known insect-destroying proclivities, have justly rendered them great favorites; and the farmer, in protecting them and encouraging them to take up homes near his orchards and gardens, has taken care of some of his best friends.

LONG-BILLED MARSH WREN, (*Cistothorus palustris.*)—Cab.

This interesting and not generally well known little bird is a summer inhabitant of New England. Although not uncommon in Massachusetts and the other two southern States, it seldom ventures north of the first State, where it is confined to the neighborhood of the salt-water marshes. It makes its appearance about the middle of May, and its presence is soon made known by its lively chattering song and grotesque dodgings among the reeds and tall grass in which it makes its home. I cannot refrain from giving the following exceedingly interesting account of its habits, &c., by Wilson:

"The marsh wren arrives in Pennsylvania about the middle of May, or as soon as the reeds and a species of nymphea, usually called splatter-docks, which grow in great luxuriance along the tide-water of our rivers, are sufficiently high to shelter it. To such places it almost wholly limits its excursions, seldom venturing far from the river. Its food consists of flying insects and their larvæ, and a species of green grasshopper that inhabits the reeds. As to its notes, it would be mere burlesque to call them by the name of song. Standing on the reedy borders of the Schuylkill or Delaware, in the month of June, you hear a low crackling sound, somewhat similar to that produced by air-bubbles forcing their way through mud or boggy ground when trod upon; this is the song of the marsh wren; but as, among the human race, it is not given to one man to excel in everything, and yet each, perhaps, has something peculiarly his own, so, among birds we find a like distribution of talents and peculiarities. The little bird now before us, if deficient and contemptible in singing, excels in the art of design, and constructs a nest which, in durability, warmth, and convenience, is scarcely inferior to one, and far superior to many, of its more musical brethren. This is formed outwardly of wet rushes mixed with mud, well intertwined, and fashioned into the form of a cocoanut. A small hole is left two-thirds up for entrance, the upper edge of which projects like a pent house over the lower to prevent the admission of rain. The inside is lined with fine soft grass, and sometimes feathers, and the outside, when hardened by the sun, resists every kind of weather. This nest is generally suspended among the reeds, above the reach of the highest tides, and is tied so fast to every part of the surrounding reeds as to bid defiance to the winds and the waves. The eggs are usually six, of a dark fawn color, and very small. The young leave the nest about the 20th of June, and they generally have a second brood in the same season."

I am unable to add anything of any value to this description. Several nests in my collection from various localities in New England and elsewhere agree with the above description of nest. They are formed of reeds and grasses twined strongly together in a bulky fabric, and the entrance is on one side, (facing the south always, I believe,) a small round hole. The cavity is deep and lined with soft grasses and feathers. The eggs are of a mahogany color, with fine dots covering the entire surface. These dots are darker than the ground color, and so fine as to be hardly visible. A great number of eggs vary from .60 by .48 to .56 by .42 inch in diameter.

SHORT-BILLED MARSH WREN, (*Cistothorus stellaris.*)—Cab.

Like the preceding species, this bird is limited to the southern districts of New England, Massachusetts forming its northern limit. It makes its first appearance about the middle of May, sometimes a little earlier. The nest is built about the last week in May; it is constructed of grasses and sedges, and is pensile, or rather suspended in tall grass in fresh-water meadows, which is woven into the body of the fabric; I have never noticed any mud in the materials, and doubt if any is used; the entrance is on the side; it is a small hole just under the greatest bulge of the nest; the whole fabric is lined with soft down from flying seeds, and sometimes a few feathers. The eggs are sometimes eight or nine in number, usually about six; their color is pure white, and the shell is extremely thin and brittle. The dimensions vary from .57 by .44 to .50 by .40 inch. But one brood is reared in New England.

HOUSE WREN, (*Troglodytes aedon.*)—Vieillot.

This interesting and well-known little bird is very generally distributed throughout New England. It arrives from the south as early as the first week in May, and soon appears about its old haunts in the garden and orchard. The familiarity of this species with man is well known, and comfortable quarters are provided for its reception, oftentimes in the piazza of a dwelling-house or in the casement of a window. This little bird is rather quarrelsome, and often drives from its home the blue bird and martin, occupying the prepared nest for its own domicile. When it builds a nest of its own, it selects a hole in a tree, or post in a fence, and fills the whole cavity with sticks and twigs; this mass is hollowed in the centre, and lined with fine grasses, feathers, wool, and other soft materials. The eggs are usually six in number, sometimes eight, and I have known as many as ten being found in one nest; their color is a pale reddish flesh-color covered with fine dots or sprinkling of a darker color. Dimensions vary from .62 by .50 to .59 by .48 inch. Occasionally two broods are reared in the season, but, as a general thing, one brood only. The wrens are extremely beneficial in the garden and orchard; they destroy immense numbers of insects and their larvæ, and are, in consequence of their sociable habits and pleasant dispositions, great favorites; it is hardly necessary to say a good word in their favor, as they are well appreciated and protected.

AMERICAN CREEPER—BROWN CREEPER, (*Certhia Americana.*)—Bonap.

This species is a resident of the three southern New England States through the year; in the other States it is a not common summer visitor. It arrives from the south about the middle of April, and, on pairing, commences building about the second week in May. The nest is built in a hollow limb of a tree, in a deserted nest of a woodpecker or squirrel, or a hole in a fence-post. Usually the locality is chosen in the deep woods, and seldom near dwellings or in the orchards. The materials used in the construction are soft grasses, feathers, and the bark of the cedar and grape-vine. The eggs are usually about six in number; their color is a dull gray, and they are marked, thickest near the great end, with small spots of reddish brown and a few dabs of a darker color. Mr. Allen speaks of a nest being found "in a large elm in Court Square, Springfield, about ten feet from the ground, and built behind a strip of thick bark that projected in such a way as to leave a protected cavity behind it." Dimensions of eggs average about .70 by .50 inch. But one brood is reared in the season in New England.

RED-BELLIED NUTHATCH, (*Sitta Canadensis.*)—Linn.

This bird breeds in the northern parts of New England. It is a not uncommon species about the region of the Umbagog lakes, in Maine, through the summer, but I have never been so fortunate as to find its nest; neither have I found the nest of the white-bellied nuthatch, which probably breeds in the same localities. Audubon, in describing the nest of the red-bellied nuthatch, says:

"I found it building its nest near Eastport, in Maine, on the 19th of May, before the blue bird had made its appearance there, and while much ice still remained on the northern exposures. The nest is dug in a low dead stump, seldom more than four feet from the ground, both the male and the female working by turns, until they have got to the depth of about fourteen inches. The eggs, four in number, are small, and of a white color, tinged with a deep blush, and sprinkled with reddish dots. They raise, I believe, only one brood in the season."

The white-bellied nuthatch is much the most common in New England, and undoubtedly breeds as far south as Massachusetts, as I have seen numbers of them in the summer months. These birds, as are also the preceding and succeeding species, are very beneficial; they destroy great numbers of injurious insects and their larvæ, and particularly the canker-worm, which is rejected by most other birds, but is eaten by these species.

BLACK-CAP TITMOUSE—CHICKADEE, (*Parus artricapillus.*)—Linn.

This well-known little bird is a very common resident of all New England throughout the year. It is one of the very few species that are as abundant in the depths of winter as through the summer, and it is, deservedly, one of the greatest favorites. It commences building as early as the second week in May The nest is placed in a hole excavated in a dead tree or stump. This hole is like that of the woodpecker's, gradually widened at the bottom, and is about nine or ten inches in depth. The nest is constructed of soft moss and the hairs of different animals. One beautiful specimen that I found in the northern part of Maine is composed of the hair of the common deer, moose, and hare, a few feathers of the ruffed grouse, and a few fragments of soft mosses. They are woven into a warm and comfortable fragment.

The eggs are from six to ten in number, usually about six; they are of a nearly pure white color, with a faint reddish tint, and are spotted thickly at the greater end, with markings of reddish brown; their form is nearly spherical, and their dimensions vary from .65 by .52 inch to .60 by .50 inch. Two broods are often reared in the season.

PURPLE FINCH, (*Carpodacus purpureus.*)—Gray.

This species, although quite common in many localities of New England, is very irregularly distributed. For instance, it breeds abundantly in and near Cambridge, Massachusetts, but is not found in any other part of the State in any thing like the abundance that it is there. In that locality it is almost the most common bird breeding; in other localities it is occasionally found in only detached pairs. So in Maine; it is common in the neighborhood of the Umbagog lakes, but elsewhere it is not often seen. There seems to be, as Mr. Allen justly remarks, a great increase of this species within the last few years, and it is beginning to be one of our most common birds. The birds separate into pairs soon after their arrival, about the middle of April, but do not commence building before the middle of May. They are occasionally resident here through the mild winter, but, as a general thing, they arrive in New England in flocks of ten or a dozen about the last of March. The nest is built in a pine or cedar tree usually, and is sometimes thirty or even forty feet from the ground—oftener about fifteen or twenty. It is constructed of fine roots and grasses, and is lined

with horse-hair and hog's bristles. One specimen in my collection has the cast-off skin of a snake woven in the rest of the fabric; and I have seen nests lined with mosses. Generally, hairs of different animals form the lining, and roots and grass the main structure.

The eggs are of a beautiful bluish-green color, and marked with spots and streaks of black; their form is a sharply pointed oval, and their dimensions vary from .94 by .64 inch to .88 by .60 inch. Two broods are often reared in the eason.

YELLOW BIRD—THISTLE BIRD—GOLDFINCH, (*Chrysomitris tristis.*)—Bonap.

This well-known bird is a very common summer inhabitant of all New England, and in the southern districts remains through the year. Notwithstanding its being here through the early spring, it does not begin to build before the middle of June. The earliest nest that I ever heard of was found June the 10th, and very few are found as early as the middle of that month. The nest is usually placed in a forked branch in an apple tree in the orchard, sometimes in a maple or birch tree near the road-side; it is constructed of soft strips of the cedar and grape-vine bark; these are very neatly woven together into a compact structure, which is deeply hollowed and lined with soft down from the thistle, and sometimes a few feathers. The eggs are usually four in number; their form is a sharply pointed oval, and their color a bluish white. Dimensions vary from .68 by .53 inch to .62 by .50 inch. But one brood is reared in the summer.

SAVANNAH SPARROW, (*Passerculus Savanna.*)—Bonap.

This bird seems to be rather irregularly distributed throughout New England in the summer season. In the eastern part of Massachusetts it is quite common; in the western part " chiefly a spring and autumn visitant," but " not common." Mr. Allen has never found it breeding in the neighborhood of Springfield, but in the neighborhood of the sea-coast in the same State it is abundant in the breeding season. On the contrary, in Maine it is not at all common near the sea-coast, but in the interior, even as far as the western borders, it is one of the most plentiful of sparrows. It arrives in Massachusetts as early as the first week in April; in Maine seldom before the middle of that month. About the first week in May in Massachusetts, and later as we advance north, the birds commence building. The nest is built on the ground, usually under a tussock of grass; it is constructed of fine grasses and roots, which are bent and twined together rather neatly, and the whole is lined with hair-like roots and fine grass. The eggs are usually four in number, grayish white in color, and covered irregularly with spots of umber brown and lilac; their form varies from long and slender to quite short and thick; their dimensions vary from .76 by .60 to .72 by 58 inch. Two broods are often reared in the season. This species rather prefers pastures and fields at a distance from houses for a home to their more immediate neighborhood.

GRASS FINCH—BAY-WINGED BUNTING, (*Pooecetes gramineus.*)—Baird.

This sparrow is abundantly distributed throughout New England in the breeding season. It arrives about the first week in April, and commences building about the last of that month in Massachusetts; in Maine about the 1st of June. The nest, like the preceding species, is built in open, dry pastures and fields, at the foot of a tuft of grass, and is composed of the same materials and constructed in the same form as the others; and I would here remark, that of our New England sparrows it is impossible to distinguish most species either in manner and material of nest, and form and color of eggs, in

the great variations which exist in them. The descriptions already given and those which follow are made from the average specimens, or in the forms in which they are most often met. The eggs of the grass finch are usually about four in number; they are of a grayish, livid white color, and marked irregularly with spots of obscure brown, over which are blotches of black. Dimensions of specimens from various localities vary from .88 by .60 to .76 by .58 inch. Two broods, and sometimes three, are reared in the season.

YELLOW-WINGED SPARROW, (*Coturniculus passerinus.*)—Bonap.

This bird is irregularly distributed. In Massachusetts it is rare near the sea-coast, but in the western part is an "abundant summer visitant; arrives about the first week in May, and leaves in autumn the earliest of the sparrows."—(Allen.) It is not included in Mr. Verrill's list of Maine birds, and I have never met with it in that State or the other two northern ones, although it probably occurs there, but not abundantly. The nest is built, like the two preceding species, on the ground, in the same localities, and of the same materials; but the eggs are different, being pure white in color, with thinly scattered spots of reddish brown; they are usually five in number, and their dimensions vary from .78 by .60 to .74 by .58 inch. Two broods are often reared in the same season.

SHARP-TAILED FINCH, (*Ammodromus caudacutus.*)—Swainson.

Massachusetts seems to be the northern limit of this species. In this State and those south it is not uncommon, but is confined to the districts in the neighborhood of the coast, and is never found more than a mile or two from those localities in the breeding season. About the last week in May the nest is built; this is placed in a tussock of grass above the tide-marks, and is constructed of coarse grasses, which are woven into a strong fabric and lined with finer grasses and sea-weed. The eggs are generally five in number, their color is a bluish white, which is covered with fine brown dots; these dots are coarser in some specimens, and almost confluent near the greater end. Dimensions vary from .80 by .64 inch to .76 by .60 inch. But one brood is generally reared in the season in this latitude.

SEASIDE FINCH, (*Ammodromus maritimus.*)—Swainson.

This bird's habits and distribution are the same as those of the preceding species, as also are the nests and eggs; it is impossible to distinguish them when placed side by side.

WHITE-THROATED SPARROW—PEABODY BIRD—WHEAT BIRD, (*Zonotrichia albicollis.*)—Bonap.

This beautiful sparrow arrives in Massachusetts by the first week in April. It does not tarry long, but passes north, and breeds abundantly in the northern districts of New England. I have found the nests as early as the last week in May, but generally they are not built before the 10th of June. They are placed under a low bush on the ground, sometimes in swamps and pastures, sometimes in high woods and ledges; they are constructed of fine grasses, twigs, and mosses, and lined with finer grasses, and sometimes a few hair-like roots. Some specimens that I have collected in northern Maine were placed in a hollow in a mossy knoll, which was scratched by the birds to the depth of the whole nest. The eggs are usually four in number; their color is a grayish white, and marked with spots and confluent blotches of brown and obscure

lilac. A number of specimens collected in different localities in Maine exhibit the following variations in size: .92 by .64 inch, .92 by .60 inch, .90 by .62 inch, .86 by .62 inch. But one brood is reared in the season. This bird is a great favorite in the north, and justly so; it is one of the sweetest songsters of the localities where it is found, and having no bad precedents with the farmer, and being of a sociable, lively disposition, it is no wonder that it meets with great favor.

SNOW BIRD, (*Junco hyemalis.*)—Sclater.

This interesting and well-known little species is an abundant inhabitant of New England. In the spring it migrates from the southern districts, where it spends the winter, to the northern sections, and late in fall returns to its winter home. A few pairs breed in Massachusetts on the Holyoke mountains, and in New Hampshire on the White mountains, but the great numbers pass to the northern districts to spend the summer, and near the Umbagog lakes and north to the Canada frontier it is the most common species. I have been so fortunate as to find a number of the nests; some had eggs as early as the last week in May, and others as late as the middle of July; therefore two broods are probably reared. The nests are constructed of fine grasses and leaves, and are placed sometimes in a slight hole scratched in a mossy knoll, sometimes in an old stump of a tree or in a tuft of grass in a thicket of bushes. The eggs are usually four in number; they vary in color from nearly pure white with reddish spots, to grayish white with reddish brown spots, and bluish white with a roseate tint and spots of umber, reddish brown, and lilac. Dimensions vary from .76 by .60 inch to .70 by .56 inch.

FIELD SPARROW, (*Spizella pusilla.*)—Bonap.

This bird makes its appearance about the 1st of April in Massachusetts, and soon scatters throughout New England. It prefers retired situations on "dry hills and pastures, and open, bushy, secluded woods, living much in trees."—(Nuttall.) About the middle of May the first nest is built; it is constructed of stalks of dried grass and fine twigs, is loosely put together, and placed usually on the ground beneath a bush, sometimes in a bush; it is lined with fine grass and horse-hairs. The eggs are usually four in number; they are of a grayish white color, with thinly scattered spots and blotches of reddish brown and lavender; dimensions vary from .72 by .52 to .70 by .50 inch. Two broods are reared in the season.

CHIPPING SPARROW—HAIR BIRD, (*Spizella socialis.*)—Bonap.

This very common and well-known little species makes its appearance in Massachusetts sometimes as early as the 10th of March,* usually about the 1st of April, and spreads throughout New England. The habits are so well known that any description here is a superfluity.

About the first week in May the nest is built. It is placed in an apple tree in the orchard, or in a lilac bush under the windows of a dwelling-house, and I found nests in low juniper bushes in the deep woods in Maine. It is constructed of fine twigs and roots, and grasses, and is lined with horse-hairs almost invariably; hence its name, in some localities, of "hair bird," "hair sparrow." The eggs are usually five in number. Their color is a bluish green, and they are marked with spots and lines of black and obscure brown, which are thickest at the great end; some specimens have these spots confluent into a sort of ring. The dimensions vary from .74 by .50 to .70 by .48 inch. This species is the

* I am indebted for the time of the arrival of this as of many other species to Mr. H. A. Purdie, of Boston, who has kindly furnished me with full and copious notes and memoranda on the arrival of species, which are of value, having been conducted for several years.

most often chosen by the parasitic cow bird as a parent for its young, and many ornithologists account for its persistent familiarity with man by this fact; there seems to be some ground for the belief that it should seek this protection from its persecutor.

SONG SPARROW, (*Melospiza melodia.*)—Baird.

This species is one of the most common and well known of our summer visitors. It arrives from about the first week in March to the middle, and commences building about the middle of April—sometimes earlier, and I have found the nest with eggs when there was an inch or two of snow on the ground. The nest is usually built on the ground, sometimes in a low bush, and occasionally in low trees; it is constructed of stalks and leaves, of grasses and weeds, and is lined with softer grasses and fine weeds. The eggs are four or five in number, and they are subject to great variations in form and markings; they exhibit all the changes from grayish to bluish white, with spots, thinly scattered, of reddish brown, to confluent blotches of umber brown, thickest at the greater end. Dimensions vary from .94 by .64 to .78 by .62 inch. Four eggs in one nest measured .94 by .64, .84 by .66, .80 by .58, .78 by .62 inch. Two broods, and sometimes three, are reared in the season.

SWAMP SPARROW, (*Melospiza palustris.*)—Baird.

This bird, although not rare, is not so common as the preceding. It is about equally distributed throughout New England, and breeds in all these States. It arrives from the south about the first week in April in Massachusetts; in Maine about a fortnight later. It prefers the swampy localities to all others, and is seldom found at any distance from such places. The nest is built about the 10th of May; it is constructed of leaves of grass and fine hair-like roots, and lined with finer of the same; these are adjusted into a loose fabric, and placed in or beneath a tussock of grass in a swamp. I have known of instances of its being found in a low barberry bush, but such cases are extremely rare, and form exceptions to the rule. The eggs are four or five in number; their color is a grayish white, with sometimes a bluish tint, and marked with thinly scattered spots of brown over the entire surface, except a circle around the greater end, where they are confluent and hide the primary color. Dimensions of a great number vary from .80 by .58 to .76 by .54 inch. Two, and sometimes three, broods are reared in the season.

ROSE-BREASTED GROSBEAK, (*Guiraca ludoviciana.*)—Swainson.

This beautiful bird is a not very common summer inhabitant of New England. It seems to be pretty generally distributed, but is in no locality plenty. It arrives about the first week in May in the southern districts of these States, and a fortnight later in the northern sections. It prefers the neighborhood of a swamp, and is most often found in low growths of birches and alders. The nest is placed in low shrubs and trees, often in the barberry bush and alder, usually in the deep woods, sometimes in a pasture. It is loosely constructed of twigs and roots, and lined with grass and hair-like roots, and sometimes a few leaves. The eggs are usually four in number—more often less, than more; their ground color is a greenish blue; this is irregularly covered with fine spots and dashes of umber brown, thickest at the greater end of the egg. Dimensions vary from 1 by .74 to .90 by .70 inch. One brood only is reared in the season in New England. I am aware that this description differs from those that have been written of the nest and eggs of this bird,* but it is correct. I have had a

* According to Bonaparte its nest is concealed amidst the thick foliage of the shady forest; externally it is composed of twigs, and lined with slender grass; and the eggs are four or five white, spotted with brown. (Nuttall.)

number of the eggs, and have seen several of the nests; these were invariably of the above description, and differed in no essential particular, though from various localities.

INDIGO BIRD, (*Cyanospiza cyanea.*)—Baird.

This species is pretty generally distributed throughout New England as a summer visitor, and is rather common in thickly settled districts. It arrives from the south about the 10th of May, and commences building about the last of that month. The nest is usually placed in low bushes, often bramble and brier bushes, usually near houses and gardens; it is constructed of coarse sedge grass, some withered leaves, and lined with fine stalks of the same and the slender hair-like tops of the bent grass, (*agrostis,*) with a very few cow-hairs, though sometimes they make a substantial lining of hair. The eggs are four or five in number, and their color is a nearly pure white, sometimes with a bluish tint. Size varies from .80 by .60 to .70 by .52 inch. But one brood is reared in the season in New England.

CHEWINK—TOWHEE BUNTING—GROUND ROBIN, (*Pipilo erythrophthalmus.*)—Vieillot.

This well-known species, although common in Massachusetts and the other southern New England States, is rare in the three northern. It begins to grow scarce in the northern districts of Massachusetts, and soon will be found only accidentally. It makes its appearance about the 20th of April, and commences building the second week in May. The nest is placed on the ground, usually beneath a clump of bushes, sometimes in a pile of old brush and faggots; the locality is usually in a low growth of birches and cedars, and very often in a pasture near houses. The nest is constructed of fine twigs, leaves, and grasses, and is lined with fine grasses and sometimes a few hair-like roots. Nuttall says:

"Most of the nests in this vicinity are made in solitary dry pine woods, without any other protection than some small bush, or accidental fallen leaves; and the external materials, rather substantial, are usually slightly agglutinated strips of red cedar bark, or withered grass with a neat lining of the same and fallen pine leaves, the lining sometimes made wholly of the latter."

My observation has been that the localities chosen for breeding places are not woods of the above character; but in other respects Nuttall's description agrees with all the nests I have seen. The eggs are usually four in number; their ground color varies from grayish to reddish white.

SKUNK BLACKBIRD—BOB-O'LINK—REED BIRD—RICE BIRD, (*Dolichonyx oryzivorus.*)—Swainson.

This very common and well-known bird is abundantly scattered throughout New England as a summer visitor. It seldom arrives before the tenth of May, when the males precede the females about a week, and the nest is not built before the last of that month. It is placed on the ground, usually beneath a tussock of grass, in a field or meadow, and is very ingeniously and most often successfully concealed; it is constructed of grasses, which are so loosely arranged as to be hardly worthy the dignity of the name of nest. The eggs are usually four in number; they vary in color from a light brown, with obscure spots of darker brown, to a dirty gray color with bold blotches of brownish black. Dimensions vary from .90 by .65 to .86 by .62 inch. But one brood is reared in the season. This bird is no great favorite in the southern portions of the United States, because of its habit of visiting the rice fields in immense numbers and devouring and destroying great quantities of that grain; but in

New England it is a general favorite. Its food while here consists of "all kinds of insects and worms," "the various kinds of grass seeds," "crickets and grasshoppers, as well as beetles and spiders."

COW BIRD—COW BLACKBIRD—COW BUNTING, (*Molothrus pecoris.*)—Swainson.

This common and well-known bird is abundantly distributed throughout New England as a summer visitor. It makes its first appearance about the middle of March in Massachusetts, and instead of mating and separating into pairs remains in small flocks through the summer.

In the breeding season no couple manifest any decided preference for one another. Another curious peculiarity of this species is its habit of laying its eggs in the nests of other birds, usually but one in a nest, instead of building its own nest, and allowing its young to be hatched and reared by the parents that are thrust upon them. The birds chosen for this office are all of smaller size than the cow bird; those most often taken are the warblers and sparrows. The eggs of this species are of a grayish white, with fine spots of brown over the entire surface. Dimensions vary from .96 by .70 to .80 by .62 inch, which, in some specimens, is marked with very minute reddish dots, which are scattered over the entire surface; others have bold dashes and confluent blotches of brown, thickest at the greater end. Their form varies from elongated oval to nearly spherical. The dimensions of a nest complement of four eggs, collected in Quincy, Massachusetts, are 1 by .74 inch, .96 by .72 inch, .90 by .70 inch, .90 by .68 inch; other specimens do not vary materially from these measurements. But one brood is usually reared in the season. This bird, although subsisting principally on various seeds and small fruits, destroys great numbers of insects, particularly in the breeding season; in fact its young are fed entirely on insects and their larvæ, and the well known wire-worms.

RED-WINGED BLACKBIRD—SWAMP BLACKBIRD, (*Agelaius phœniceus.*)—Vieillot.

This very abundant species is a summer resident of all New England, but in the northern districts is not nearly so common as in the southern. It arrives from the south in small parties, sometimes as early as the first week in March in Massachusetts, but in Maine not before the 20th of that month. It commences building about the first week in May. The nest is usually placed in a tussock of grass or low bush in a meadow and swamp; it is constructed of coarse grasses which are woven and entwined into a strong fabric, into which are incorporated the grass to which it is suspended, or the twigs of the bush in which it is built. It is deeply hollowed and lined with fine grasses, and sometimes a few hair-like roots. The eggs are four or five in number, and they vary in color, two or three shades of light blue; they are marked with spots and streaks of vandyke brown and black, generally distributed thickest at the greater end. Sizes vary from 1.05 by .75 inch to .90 by .66 inch. Average size about .97 by .70 inch.

This species in many localities is far from being a favorite, and many are the methods by which its death is accomplished. It feeds principally on the seeds of various grasses and grains, and in the breeding season destroys great numbers of injurious insects, on which its young are fed; generally speaking, it is not a beneficial bird on the farm, for the damage it does on the grain fields, where it congregates sometimes in immense numbers, much more than balances the good it does in the destruction of insects

MEADOW LARK—MARSH QUAIL, (*Sturnella magna.*)—Swainson.

This beautiful and well-known bird is a common summer inhabitant of the three southern New England States, and is not rare in the others. In mild winter it remains through the year, but generally leaves for the south late in the fall, and returns about the "second or third week in March." It commences building about the second week in May, sometimes earlier; the locality is generally in a meadow or low field. The nest is usually built in a tussock of grass; it "is pretty compact, made of dry wiry grass, to which a hidden and almost winding path is made, and generally so well concealed that the nest is only to be found when the bird is flushed."—(*Nuttall.*)

A great number of nests that I have examined agree with this description; all were beneath bunches of grass, and, though some were only partly covered, still there was a decided roof to all. The eggs are usually four in number; their color is generally nearly pure white, sometimes reddish white, with fine spots of reddish brown diffused over the entire surface of some specimens; on others, thinly scattered spots, blotches of two or three shades of brown and lilac. Their dimensions vary from 1.10 by .85 to 1 by .78 inch. Their form is usually a rounded oval.

A rather peculiar specimen, kindly presented me by J. P. Norris, esq., of Philadelphia, is nearly spherical in form, rosy white in color, with exceedingly minute dots of reddish. Size, 1.05 by .90 inch. Nuttall says of the food of this species:

"Their food consists of the larvæ of various insects, as well as worms, beetles, and grass-seeds, to assist the digestion of which they swallow a considerable portion of gravel. It does not appear that this species ever adds berries or fruits of any kind to his fare, like the starling, but usually remains the whole summer in moist meadows, and in winter retires to the open grassy woods, having no inclination to rob the orchard or garden; and, except in winter, is of a shy, timid, and retiring disposition."

But one brood is reared in the season.

ORCHARD ORIOLE, (*Icterus spurius.*)—Bonap.

This bird is rather rare in New England, and is confined to the southern districts as a summer visitor. It arrives about the second week in May and commences building about the first week in June. The nest is usually placed in a forked branch of a tree in the orchard, seldom more than twenty feet from the ground; it is constructed of different grasses, which are woven together very neatly and compactly; the whole is lined with fine grass and sometimes a few horse-hairs. It is not pensile, but is built *on* the branch. The eggs are four or five in number; their color varies from a light blue to a fleshy tint, which is marked with irregular spots and lines of obscure lavender, over which are bold spots and blotches of black and brown. The dimensions vary from .86 to .56, by .54 inch. But one brood is reared in the season.

BALTIMORE ORIOLE—GOLDEN ROBIN—HANG BIRD, (*Icterus Baltimore.*)—Dandin.

This well-known species is abundantly scattered throughout New England as a summer visitor. It makes its appearance about the first of May in Massachusetts, and about the middle of that month in Maine in the northern districts. It commences building about the 20th of May. The nest is usually fixed in an elm tree near houses, or in an apple or pear tree in the orchard. Nuttall's description of the nest is the best that I have ever seen, and much better than any I could make; although somewhat lengthy, I give it entire:

"There is nothing more remarkable in the whole instinct of our golden-robin than the ingenuity displayed in the fabrication of its nest, which is, in fact, a pendulous, cylindric pouch of 5 to 7 inches in depth, usually suspended from near the extremities of the high drooping branches of trees, (such as the elm, the pear, or apple tree, wild cherry, weeping willow, tulip tree, or button-wood.) It is begun by firmly fastening natural strings of the flax of the silk-weed,* or swamp hollyhock,† or stout artificial threads around two or more forked twigs, corresponding to the intended width and depth of the nest. With the same materials, willow-down, or any accidental ravellings, strings, thread, sewing-silk, tow or wool, that may be lying near the neighboring houses, or around grafts of trees, they interweave and fabricate a sort of coarse cloth into the form intended; towards the bottom of which they place the real nest, made chiefly of lint, wiry grass, horse and cow hair; sometimes, in defect of hair, lining the interior with a mixture of slender strips of smooth vine bark, and rarely with a few feathers, the whole being of a considerable thickness, and more or less attached to the external pouch. Over the top the leaves, as they grow out, form a verdant and agreeable canopy, defending the young from the sun and rain. There is sometimes a considerable difference in the manufacture of these nests as well as in the materials which enter into their composition. Both sexes seem to be equally adepts at this sort of labor, and I have seen the female alone perform the whole without any assistance, and the male also complete this laborious task nearly without the aid of his consort, who, however, in general, is the principal worker."

The eggs are four or five in number; they are of a flesh color, with sometimes a bluish tint; they are marked with obscure lines of lavender, over which are irregular scratches and lines, as if done with a pen, of vandyke brown and black. Their dimensions vary from 1 by .72 to .88 by .66 inch. The food of this bird, and also of the preceding species, consists of caterpillars and other injurious insects; great numbers of the hairy caterpillars are destroyed, and sometimes a large nest of the apple tree caterpillars is depopulated in a few days. The orioles are certainly, therefore, worthy the highest consideration and protection from the farmer.

RUSTY BLACKBIRD, (*Scoleophagus ferrugineus.*)—Swainson.

This bird is not uncommon in the New England States in the spring and fall migrations, but is never plenty, and retires to high latitudes to breed. A few remain in the northern districts of Maine and New Hampshire through the breeding season, but their nests are seldom found. While in the valley of the Magalloway river, in Maine, in June, 1864, I found several, and two of them contained three eggs in each; these nests were all built in low alders overhanging the water; they were constructed of, first, a layer of twigs and brier stalks; on this was built the nest proper, which was composed of stalks and leaves of grass which were mixed with mud and moulded into a firm, circular structure, and lined with fine leaves of grass and a few hair-like roots; the whole formed a large structure, easily seen at the distance of a few rods through the foliage.

The eggs are of a bluish white color, of oval form, and covered with fine scratches and spots of light brown; these markings are almost exactly similar to those on the egg of the great-crested fly-catcher; they appear as if done with a pen, which, as soon as it is pressed forcibly on the object, is suddenly withdrawn, making a mark wide at one end, and sharply pointed at the other.

The dimensions of three eggs in my collection are: 1.04 by .76 inch, 1.05 by .75 inch; 1 by .70 inch.

CROW BLACKBIRD—PURPLE GRAKLE, (*Quiscalus versicolor.*)—Vieillot.

This very common and well-known bird is distributed throughout New England in the summer season. It arrives about the first week in April. It is a social species, and, instead of breaking up into scattered pairs, the birds remain in flocks, and breed in communities, sometimes several pairs on one tree. The nest is composed of mud, in which grass, sea-weed, fine roots, and other like

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* Asclepias. † Hibiscus palustris.

materials are mixed and woven into a large, compact structure, which is lined with fine grass, sea-weeds, and sometimes a few horse-hairs.

The eggs are four or five in number. They vary in color from light blue to light brown, and are marked with obscure spots of light brown, over which are laid blotches and lines of black and umber brown. They vary in dimensions from 1.30 by .88 to 1.18 by .84 inch. Usually but one brood is reared in the season, and in September the birds collect into immense flocks and do considerable mischief in the corn-fields; in other seasons their food consists of "larvæ, caterpillars, moths, and beetles, of which they devour such numbers that, but for this providential economy, the whole crop of grain in many places would probably be destroyed by the time it began to germinate."

Common Crow, (*Corvus Americanus.*)—Audubon.

This well-known bird is abundant through New England in the summer, and in mild winters is a resident through the year. The species—as Mr. Allen justly remarks in his catalogue of the birds of Springfield, Massachusetts—

"Seems to have diminished very materially in numbers in the last six or eight years. Hundreds, and probably thousands, having been killed in the State by the use of strychnine almost every year."

About the first week in May the birds separate into pairs and soon commence building; the nest is usually built in a fork of a tall pine, sometimes in a thick birch or hemlock; it is constructed of first a layer of coarse twigs and sticks, then a layer of the bark of the cedar, moss, and sometimes bunches of grass; it is warmly lined with the bark of the cedar, and sometimes a few leaves. The eggs are usually four in number; their color is of different shades of green, which is covered with blotches and spots of different browns, and dusky. Dimensions vary from 1.65 by 1.20 to 1.50 by 1.08 inch. But one brood is reared in the season. The crow is probably the most heartily detested of all our birds, and sometimes not without reason, but generally the good he does much more than compensates for the harm. The testimony of naturalists agrees in some important points. Wilson says:

"It is in the month of May, and until the middle of June, that the crow is most destructive to the corn-fields, digging up the newly-planted grains of maize, pulling up by the roots those that have begun to vegetate, and thus frequently obliging the farmer to replant or lose the benefit of the soil; and this sometimes twice, and even three times, occasioning a considerable additional expense and inequality of harvest. No mercy is now shown him. The myriads of worms, moles, mice, caterpillars, grubs, and beetles which he has destroyed are altogether overlooked on these occasions. Detected in robbing the hens' nests, pulling up the corn, and killing the young chickens, he is considered as an outlaw, and sentenced to destruction."

Nuttall says:

"The crow is equally omnivorous with the raven; insects, worms, carrion, fish, grain, fruits, and in short everything digestible by any or all the birds in existence, being alike acceptable to this gormandizing animal. His destruction of bird-eggs is also very considerable."

Audubon gives the following eloquent defence of this bird:

"The crow devours myriads of grubs every day in the year that might lay waste the farmer's fields; it destroys quadrupeds innumerable, every one of which is an enemy to his poultry and his flocks. Why, then, should the farmer be so ungrateful, when he sees such services rendered to him by a providential friend, as to persecute that friend even to the death?"

Blue Jay, (*Cyanura cristata.*)

This beautiful and well-known bird is abundantly distributed through New England. It is a resident in the southern sections through the winter, but in the northern districts is partially migratory; in these latter districts it is not near so common as the Canada jay, but is often seen. About the first or second week in May it commences building; the nest is usually placed in a fork of a low pine or cedar, in a retired locality; it is loosely constructed of twigs and coarse roots, and lined with the same materials, but of a finer quality, and sometimes a few pieces of moss or a few leaves. The eggs are four or five in number; their color is generally light green, with spots of light brown; sometimes a dirty brownish gray, spotted with different shades of brown and black. The dimensions vary from 1.20 by .85 to 1 by .80 inch. But one brood is reared in the season. The food of the blue jay is varied in character; in fall and winter it consists of acorns and different seeds, and sometimes "the eggs of the common tent-caterpillar in abundance." In summer it consists of worms, insects, small animals, birds' eggs and their young, fruits, reptiles, and almost anything, like the crows. Taken altogether, the blue jay probably does more harm than good on the farm; but it is pretty difficult to draw the line and pronounce for or against it.

Canada Jay—Moose Bird, (*Perisoreus Canadensis.*)—Bonap.

This species is confined to the northern districts in New England, where it is resident through the year. I have never been so fortunate as to find the nest, and will have to borrow Audubon's description of that and the eggs:

> "The Canada jay breeds in Maine, in New Brunswick, Nova Scotia, Newfoundland, and Labrador. It begins as early as February or March to form its nest, which is placed in the thickest part of a fir tree, near the trunk, and at a height of from five to ten feet. The exterior is composed of dry twigs, with moss and grass, and the interior, which is flat, is formed of fibrous roots. The eggs, which are from four to six. are of a light gray color, faintly marked with brown."

Only one brood is raised in the season.

In drawing this short paper to a close I cannot but express my regrets at its many imperfections. The science of oology is young in this country, and the breeding habits of many of our birds are still unknown. A knowledge of this exceedingly interesting branch of natural history is unquestionably of great value, and it behooves the farmers, as well as all other naturalists, to pay it at least a moderate share of consideration. There are already, doubtless, multitudes of facts concerning the periods of incubation, food of young birds, breeding habits, &c., of many rare species in the possession of many of our observing farmers, and it is but right that they should be given to the public, and I would suggest to those who are in possession of any interesting facts concerning the habits of our native birds to improve some of their spare time, in the long winter evenings, in writing them to some agricultural paper in their neighborhood; such matter is always acceptable, and is always of great value to the scientific public.

BIRDS AND BIRD LAWS.

BY J. R. DODGE, DEPARTMENT OF AGRICULTURE.

MORE than the soil is included in the farmer's realm. Its chemistry affords not the only alchemy by which the elements of nature become bread in the house and gold in the pocket The sunshine is his servitor, and the rain of heaven his helper. Insects and creeping things do something to make and much to mar his fortunes. He has dominion, also, over the birds of the air, while they cheer his labors with beauty and song, and reduce the excess of insect life, otherwise pestiferous in its great prolificacy. He cannot safely ignore or exclude their proffered service; he should not grudge the few grains and fruits that serve as a dessert for the meats that constitute their constant meal. The birds, less selfish than man, give much and take little. Man, in his ingratitude, accepts the large service and refuses the small reward, adding injury to denial often, and murder to baseness.

USES OF BIRDS.

There are higher utilities than mere ministries to the stomach and back. Even farmers have interests in other and less tangible products than bread and butter. The sunlight, by the word of Deity, might have been equally fructifying without its prismatic elements. The rain drop's diminutive globes of crystal purity refracting the sun's rays into rainbow hues need not for irrigation the beautiful offices which are revealed by science. The blossoms of the peach are harbingers of the delicious fruit, but why come they in such gorgeous livery? The peach itself would be just as sweet without its rosy blush. The wild flowers of the forest make no pretence of fruit for the food of men, yet they never forget to open as the fresh breath of spring comes over them, even high on the mountain's crest, where they may bloom and wither unseen by mortal eye. And the birds, too, while useful to man in the most material sense, are clothed with a softer plumage than the textures of Cashmere, and more brilliant than the dyer's richest hues; their flight is the poetry of motion, and their voices suggestive of more buoyant life and higher and more irrepressible vivacity than that of any other earthly creature. Why should a robin, a sepulchre for worms, go to his feast in such comely attire? If so beautiful and kindly a bird has instincts so spiritual, is not the soul of man to be fed as well as his stomach?

There is a *use* for all this beauty. It cheers man in his labors. In the sweat of his face he earns his bread; but his toil is not that of the solitary criminal, unblessed by light or song. If the soldier can make better marches under the martial influence of the "spirit-stirring drum" and "ear-piercing fife," so can the farmer gather inspiration from the activity and cheerfulness of birds. Were there no use in beauty, why did their Maker paint their soft plumage so gorgeously? If the dark soul of Saul could be lighted by the music of cunningly devised instruments, may not the weariness of labor be relieved by the more spiritual notes of mocking-bird or nightingale? The farmer too often hibernates like bruin in the winter, sluggish and unenterprising. With the genial spring, its balmy airs, fitful sunshine, and gushing bird songs, his soul rises to new life, elastic, like the air, and active, like the birds. Scarcely more could he dispense with cheering music than with warming sunshine or frequent showers. The

most material and gross and unimaginative of men are affected pleasurably and profitably by these elevating influences. The bird is the farmer's poet laureate, well worthy of the sovereign that should prove an appreciating friend and patron.

The birds are useful as teachers of the hidden wonders of nature. Not less "wonderfully made" than man himself are these airy creatures. How swift and graceful their flight! How etherial their music! How restless and sleepless their activity! In some the sense of sight is seemingly fabulous, in others the sense of smell is miraculously acute. How clumsy and weak is man in comparison; with vastly less of brain and weaker in muscle in proportion to size. From incubation in the groves in spring to migration in the autumn to the tropics, their whole growth and life are marvels of nature. A popular writer says of the egg: "Even the chrysalis is less amazing, for its form always preserves some trace, however fantastic, of the perfect insect, and the change is but moulting a skin; but this egg appears to the eye like a separate unit from some other kingdom of nature, claiming more kindred with the very stones than with feathery existence, and it is as if a pearl opened and an angel sang." The coloring, too, of these fragile and transient forms, infinite in its variety of marking and peculiarity of hue, is an enigma to the unpoetic utilitarian, and an additional evidence of the prodigality of beauty diffused throughout the kingdom of nature—a gift of God, not to be spurned with a high utility affecting the happiness and interests of the whole human family. They are teachers of tidiness and models of personal cleanliness. A bath is one of the essentials of bird-keeping. To be in health is equivalent to being in fine feather. The bird makes her toilet exquisitely, and never is found *en dishabille* unless *in extremis*. But the beauty of their coloring is dimmed by imprisonment, at least with the linnet—"the charming red color with which nature has painted its head and breast, and which, in a state of liberty, sparkles with enduring lustre, wears off by degrees, and even disappears entirely in our cages and voleries." Nature thus attests her appreciation of liberty. The plovers, necessarily soiling their feet in their search along the sandy beaches for their breakfast, carefully bathe them after their morning meal.

The nest of the humming-bird is a miracle of perfection in domestic economy. For beauty, fitness, and safety, the wisdom and taste displayed in its arrangement are irreproachable. Bedecked in plumage of emerald, ruby, and topaz, remarkable for the delicacy of its form and grace of its motion, unsullied by rain from the clouds or dust from the earth, and feeding upon the nectar of the flowers, its habitation should be in character, and so it is. Shaped like a half-cup, it is delicately formed of lichens colored like the branch on which it is fixed, and lined with the soft down of plant blossoms, of mullein leaves, or the young fern. It is delicately soft, sheltered, and undistinguishable from the bark of the tree, of which it seems a most natural excrescence—a moss-grown knot. Two white eggs as large as peas adorn the nest, upon which, as is asserted by some naturalists, the cock and hen sit by turns for ten or twelve days. The little birds, scarcely larger than flies, enter upon their existence in a chamber tapestried as with velvet, and are fed with the sweets of flowers from the maternal tongue. The tiny household exhibits not only a commendable neatness, but exquisite taste and delicacy in all its arrangements. Can gentle humanity derive no lesson from such an example?

In conjugal fidelity and parental affection the birds, with few exceptions, are highly distinguished. The parents unite their labors in house-building and share the cares of incubation, the mate watching constantly in the vicinity and cheering the female in her confining duties, and afterwards the happy pair are assiduous in their efforts properly to feed and rear their young and defend them during their period of helplessness. Females have been known to die of starvation rather than quit the nest during incubation. The most timid will brave the dangerous approach of man, leaving the nest only upon the closest proximity of

intruders, and soon returning even at the risk of capture or death. Common as this maternal instinct is in most living things, it has its most beautiful exemplification in birds.

A BALANCE IN ANIMAL PRODUCTION NECESSARY.

The disturbance of the proper balance between the feathered and insect tribes is fraught with incalculable mischief, affecting the food, the health, and the life of man. The weakening of a single link in the chain of being is often productive of great loss.

The reproductive energy of nature is miraculous. The lower links in the series of animal creation wonderfully illustrate this power. Minute, almost microscopic life, becomes the prey of superior strength or cunning; the law of the stronger in turn subjects the conqueror to the same fate, and thus life is transmuted into higher life, and the chain of being becomes a living indissoluble line. Man, by his artificial habits, disturbs the harmonious workings of this law of production. He dams streams and annihilates a migratory race of fish. He cuts down forests and destroys the haunts of woodland birds. By careless management of seeds and careless treatment of soils he stimulates the production of an insect which becomes an intolerable pest. As if this were not enough, he destroys the feathered tribe in sport, hunts and despoils their nests, and kills them unseasonably for food, and thus disturbs the balance among the myriad orders of animal creation. As a rule, the more worthless a race the more prolific. Birds rear but few young—some of them hatch but two, and generally they incubate but once a year. The chances against their life are numerous. They are the prey of the lower animals as well as of man. Their eggs invite the voracity of many tribes; the wary cat entraps and captures them. Man, to whom they are a constant benefaction, too often acts as if he were a perpetual enemy. Of all creatures birds seem most liable to suffer injury, and even to risk extermination. A few examples of insect prolificacy may illustrate the danger of disturbing the balance of the races by the destruction of birds:

The *Aphides*, or plant-lice, are found everywhere, almost every plant having a variety peculiar to itself; and some have more than one species. Their sudden appearance, often covering the whole surface of the leaf and stalk, loses its mystery when we know that they are produced alive, not hatched from eggs, except the last generation in the season, and that the progeny are all females, themselves growing to maturity in a week or two and producing females, closing the season, after almost as many generations as there are weeks of hot weather, with a brood of males and females, the progenitors of a similar line of viviparous mothers for another season. Reaumer has proved that one individual in five generations may become the progenitor of six thousand millions. Small as it is, the Aphis has enemies—the larvæ of a little fly, the grubs of the *Coccinella*, or lady-bird, and also those of another and similar species.

All persons familiar with the culture of tobacco are aware of the reproductive power of the tobacco worm. As if to check their excessive increase, a parasite ichneumon fly punctures a worm, desposits its eggs, which hatch, destroy the worm, and go forth in sufficient numbers, according to Dr. Fitch, to destroy two thousand five hundred other tobacco worms. In turn, a little parasite resembling the Hessian fly, pierces the cocoons containing the ichneumon parasite and metes out the same treatment suffered by its victims.

The *Coccus cacti*, a bark-louse infesting a species of cactus, becomes the cochineal of commerce when dried. It is said that 70,000 insects are required to make a pound, and that England alone consumes 150,000 pounds, or 10,500,000,000 specimens of this *coccus*. An Indian woman may be seen in Mexico sitting for hours before a single plant brushing off these insects with a squirrel's tail. The cochineal grower lays annually his stock of newly hatched insects known as

semilla or seeds upon the branches of the plant, and washes the growing plants carefully with a sponge to prevent admixture of other insects.

Locusts, when circumstances have favored undue production, have caused famine by their destructiveness, and pestilence by their destruction. In France boys are employed to gather and destroy their eggs. One of them often secures fifteen pounds daily. A farmer in New Hampshire is said to have caught in four hours of one night, by means of a net improvised from two sheets, five bushels and three pecks of grasshoppers.

Mosquitoes have appeared in such numbers as to resemble a dark cloud, heralded by the ceaseless hum of myriad wings, which, if Baron Latour tells truly, vibrate three thousand times per minute.

The Bible chronicles the insect plagues that punished Pharaoh and Egypt—a result, it may be, of natural causes supernaturally induced. Sopor, king of Persia, is said to have raised the siege of Nisibis in consequence of a plague of gnats. And in the frigid climate of Lapland gnats sometimes fill the atmosphere, getting into the mouth, eyes, and nostrils, and inflicting great torture by their peculiar tittillation. Arthur Young, in his travels through France, said, if he were a farmer there he would manure four or five acres every year with dead flies. Flies are everywhere an acknowledged nuisance; in hot countries, in which the length of the season furnishes ample opportunity for geometrical ratios of numbers numberless, no place is exempt from their intrusion.

> "A thousand shapes of variegated hues
> Parade the table and inspect the stews."

The larvæ of the ichneumon flies, as if to atone for the mischief of the family, industriously puncture the eggs of some insects, oviposit in the bodies of others, and even infest the wire-worm which burrows in the earth in numbers so marvellous, being the product, in their numerous varieties, as stated by naturalists, of seventy species of beetles. A single pair of grain weevils have produced 6,045, propagating from April to August. Curtis says that one female Y moth might, in twelve months, produce 16,000,000 caterpillars. In a single tree 80,000 bark-boring beetles have been found. Flint says that a female cockchafer lays from 100 to 200 eggs, which are hatched in two weeks. So prolific are they that they have been known to undermine whole acres of meadow, destroying the grass by eating the roots. To reduce their numbers, an enterprising beetle in a brilliant coat, the *scarabeus auratus* (European) attacks and kills female cockchafers in the moment of oviposition, (or egg laying,) preventing the production of thousands of grubs.

Not only does one species feed upon another, but certain insects devour their own kind. Female mole-crickets, it is asserted, eat nine-tenths of their offspring. It seems to be a wise provision of nature to assist the destructiveness of their natural enemies and prevent an increase that would breed a famine, their females laying 300 to 400 eggs. The cowardly *mantis* is cruel, though it flies before an ant, devours great numbers of flies, and the female eats the male after copulation. Caterpillars, with similar instincts of cannibals, have devoured each other till only one remained when enclosed without other food in a close jar.

Earth, air, and water are astir with living things; living flesh and growing vegetable fibre are attacked by them, and disorganizing animal and vegetable remains made their food. No substance is too offensive for their use; nothing too innutritious for their food; even the stone of the date is pierced by an insect. It is said there are six varieties of insects to one of plants in Europe, and Mr. Flint estimates four to each plant in Massachusetts. Dr. Hitchcock enumerates 2,300 specimens of the insects of Massachusetts.

The excessive reproduction of insects, rendered more disproportionate by the unintentional extermination of birds, (not to mention actual warfare upon them,)

is something more than a mere annoyance. It is positive loss, absolute and alarming destruction of the products of industry, representing throughout the world the labor of millions of men. A Swedish fly, for example, is estimated to destroy one-tenth of the grain of certain districts of that kingdom. In Devonshire county, England, the turnip beetle has caused, in one season, a loss of $500,000 in turnips. In Norfolk county the entire produce of thousands of acres has been destroyed by the black caterpillar of the saw-fly. In France, during two years, 100,000 rose trees were lost by a single florist from the larvae of the cockchafer. In the Hartz forests, in Germany, 1,500.000 of trees were killed in a few years by a bark-boring beetle. The locusts have always been symbols of famine. Days of fasting and prayer were set apart in New England on account of their ravages. The Arabians, personifying the locust, represent them as thus address ng Mahomet: "We are the army of the great God, and produce ninety-nine eggs. If the hundred were completed, we should consume the whole earth and all that is in it." They were wont to give it, in description, "the elephant's eyes, a bull's neck, stag's horns, a lion's chest, a scorpion's belly, and a serpent's tail."

Colossal fortunes, almost in the grasp of the cotton-growing speculators in the south last year, were eaten by the army worm. It would be quite safe to say that insects destroy 5,000,000 bushels of wheat yearly in the United States, and 10,000,000 would not be a large estimate for some seasons. In Nebraska, the potato beetle is so common that an observer writes that, "killing it seems to do no good, they breed so rapidly." In Trinidad, an ant was said to be in such great excess at certain times that rats, mice, and quadrupeds become an easy prey; streams were bridged with their own bodies, and fires started to stay their progress were extinguished by their numbers. An African ant, the *Termes fatalis*, living in clay nests, excavates tunnels in the earth for hundreds of feet around, bores through the posts and supports of buildings, enters the roof and destroys houses and whole villages; it has even invaded the ocean and destoyed a British ship-of-the-line. Twenty-seven folio volumes have been perforated in a straight line by a single specimen of the wood-borer, the *Anobinum pertinax*.

It is unnecessary to tell housekeepers of the ravages of moths, some varieties of which have been known to eat horse-hair. They are so destructive upon furs, which they sometimes shave as with a razor, that London merchants have offered £20,000 for a remedy for their ravages.

If an estimate approximating the whole truth could be made, the annual loss from insects in the country would astonish every one Many years ago, it was assumed to average $20,000,000. The difference always seen between the real producing capacity of good land and their average production is amazing. Land that may yield thirty and even forty bushels of wheat per acre, actually produces less than fifteen. The average product of corn is little more than half what it should be; yet corn is the surest crop, partly because less liable to loss from insects. Making the smallest reasonable estimate of the proportion of this great deficiency properly chargeable to insects, and taking in view the number of products and the large figures representing the quantity of each, it must be evident to all that many millions of dollars would be saved to industry by keeping these numerous tribes in proper equilibrium.

Yet it is not the *destruction* of all insects that is desired in pleading for the preservation of birds, but the securing of a proper balance in the relations between all these necessary and useful classes of living creatures. None are without their legitimate uses. Who has not observed the busy beetles, scavengers in detail, taking what the fly and his maggots have left, after the hyena and the vulture have gorged themselves and fled, leaving nothing but the bone? Insects fabricate the beautiful coral in masses capable of sinking a squadron, or chang-

ing an ocean current. Silk, the most beautiful of textiles, and honey, the richest of sweets, are of similar humble origin.

The most beautiful of scarlet dyes is from cochineal, dried insects of the *coccus* family. India ladies imprison in their tresses a brilliant fire-fly; the Chinese belle decorates her robes with the shells of the beetle; and Brazilian maidens wear necklaces of diamond beetles. In medicine, the *cantharis* is prominent with the blistering fraternity; a lint made by a certain ant stops the most violent hemorrhages. Queer fancies in ancient medicine have prevailed: the wood-louse has been used as an aperient; millipedes for jaundice; powdered scorpions for the gravel; the silk-worm for the vertigo; ear-wigs to strengthen the nerves; fly-water for the water; cockchafers for *rabies;* and gnats as a purge. Moles aerate the soil; the larvæ of gnats and various flies, living in water, remove impurities. Many kinds of insects are eaten, and some are classed as epicurean dainties. Tropical climates would be pestilential but for the insects that clear away animal and vegetable remains; forests destroyed by hurricanes, or trees felled by lightning, are quickly disposed of by myriads of insect races, and one race furnishes food for another, so continuing through almost numberless mutations, making kindred of the whole chain of being.

THEIR UTILITY AS INSECT DESTROYERS.

If the necessity of an equilibrium in production throughout the circle of the lower order of creation has been fully shown, let the reader note a few facts, showing the utility of birds in restoring the equilibrium.

The loss of this balance, and the destruction of birds as one of its causes, has been briefly canvassed. Some persons, without investigation or reflection, have assumed that birds consume few insects. Let them visit the museum of the Department of Agriculture and examine the contents of the stomachs of birds, as prepared by Professor Glover, and they will be satisfied that their favorite and principal food is animal, and that many tribes use vegetable food (fruits and seeds, &c.,) as dessert or as a condiment.

"It is not unusual," says a well-known writer, "to behold in the American seas immense troops of birds collected to prey upon those prodigious swarms of winged insects which sometimes darken the air." Swallows feed upon flies, grasshoppers, butterflies, and beetles; and to save these birds from slaughter in the days of superstition, the cunning device was adopted to declare them under the protection of the household gods, and that when misused they revenged themselves by pecking the udders of cows, and causing them to lose their milk. Belon asserts that the "swift" swallow can see a fly six hundred yards distant. Bradley says that a pair of sparrows will destroy 3,360 caterpillars for a week's family supplies. The flycatchers do not lie in wait, but hunt for their prey, follow the plough for insects, glean the flies found molesting the cattle, and banquet upon the swarms that breed upon the margin of stagnant water. Wilson says a blackbird will destroy fifty grubs daily; even in winter its food is, in part, chrysalides and spiders. A curious observer, watching the nest of a thrush, counted two hundred and six visits to feed the young during one day. The partridge often feasts her brood upon an ant-hill. A family of plovers will destroy myriads of grasshoppers, taking them in an early stage of their existence, when little larger than flies. Owls, solemn and innocent as they look, are equal to terriers as mousers, speedily clearing mice and moles from barns and outhouses. Woodpeckers are constantly and laboriously seeking insects in the bark of trees, one variety only being accused of piercing the green bark to feed upon its juices, yet the "sapsuckers" have many friends to assert their innocence. Wrens, creepers, and tomtits hop from branch to branch, or creep around the larger branches, seeking their favorite food. Jays, crows, nighthawks, and whip-poor-wills destroy immense quantities of beetles, an exceedingly prolific

race. The robin and red-winged blackbird obtain their food almost exclusively from the ground; and quails in immense flocks have been seen to forage recently planted fields systematically in sections, and upon shooting a specimen no grain has been discovered, but cut-worms or other insects. Flagg has counted seventeen caterpillars eaten by a golden robin in a minute—a thousand daily, if one hour in the twenty-four is required for personal supplies. They are able to accomplish so much by their dainty habit of tearing in two their hairy prey, and eating only the inside of each. In "Anderson's Recreations" a curious calculation, founded upon careful observation, requires for the commissariat of a family of jays with five young ones, for a season of one hundred days, twenty thousand insects. Bradley, an English writer, mentions watching a nest of birds, and discovering that five hundred caterpillars were consumed in one day. The sparrows and finches are understood to live mainly upon seeds, but they feed their young entirely on the larvæ of insects. The graminivorous birds are insectivorous in early life. A single pair of sparrows is reported to have carried to the nest five hundred insects in an hour.

As aids to the fruit-grower and gardener for specific objects, birds sometimes seem to have a peculiar adaptation. St. Pierre mentions a "gardener's bird" at the Cape of Good Hope, which was employed incessantly in seizing worms and caterpillars, and impaling them, when caught, upon the thorny prickles of the bushes. The flicker or spotted woodpecker has actually been seen to probe the gummy hiding places of the borer in the trunk and surface roots of the peach, and bring forth and destroy the pest. Such instances of special utility might be multiplied. While the farmer suspends his operations in winter, and comfortably occupies the chimney corner, his entomological assistant, the chickadee, reckless of the cold, prospects among the trees for insects in every crevice of the bark, and the creeper accompanying him further investigates the hidden habitations of worms. The co-operation of the birds with the farmers is, therefore, almost uninterrupted by heat or cold, climate or season. Another of the offices of birds in the economy of nature, well known, but not to be carelessly passed by, is the dissemination of seeds of trees. Their utility, their actual necessity in this respect, could be supported by the most interesting and important facts.

In this brief exhibit of the practical relations of birds with man, the facts are so suggestive of corroborative evidence in the experience of all, and so obviously genuine, that further proof of their usefulness is manifestly useless.

FALSE CHARGES REFUTED.

The birds have been arraigned as plunderers of the fields and the gardens by thoughtlessness and ignorance from time immemorial. The charge is not only unjust, but it is ungrateful. That they eat a little grain at times of that variety which is essential to health is not to be denied, and it may be true that the golden cherries sometimes prove too tempting for the accustomed moderation of the more volatile and impulsive. "To err is human," but by no means bird-like. In this respect, "bipeds without feathers" are far more blameable than bipeds with those ornaments.

"The laborer is worthy of his hire" is a maxim that farmers should respect, and no laborers work so cheaply as the birds. They provide themselves mainly from nature's own domain, yet claim the right to be fed from man's in payment for service honestly rendered. The poet felt the simple justice of their claim when he said, "The birds of heaven shall vindicate their grain!"

The farmers in foreign lands, who have employed children to gather cutworms by hand, would be glad to discharge their indebtedness with the same pay claimed by birds for the same service. The principle of compensation is an irrevocable natural law, which can no more be violated in our dealings with the birds, without violence to our moral nature, than in any other relations of God's

creatures. The birds are entitled to all they receive, and if their account is fairly entered upon the farm-books, a fat balance on the credit side would always be observable.

The poet Longfellow, in his legend of "The Birds of Killingworth," illustrates with the clearness and simplicity of truth, in poetic garb, the claims of the feathered tribes, in the case of the Farmers *vs.* The Birds. It is in the season when the purple buds expand, "the banners of the vanguard of the spring:"

> "The robin and the blue bird, piping loud,
> Filled all the blossoming orchards with their glee;
> The sparrows chirped as if they still were proud
> Their race in Holy Writ should mentioned be;
> And hungry crows, assembled in a crowd,
> Clamored their piteous prayer incessantly,
> Knowing who hears the raven's cry, and said,
> 'Give us, O Lord, this day our daily bread!'"

The thrifty farmers heard with alarm the cawing of the crow,

> "That mingled with the universal mirth,
> Cassandra-like, prognosticating woe,"

and shook their heads and doomed "to swift destruction the whole race of birds," at a town meeting, in solemn dignity convened, presided over by the squire, with the co-operation of the austere parson and the stiff deacon, notwithstanding the protests of the preceptor against a decree of banishment to those

> "Whose household words are songs in many keys
> Sweeter than instrument of man e'er caught,
> Whose habitations in the tree tops, even,
> Are half way houses on the way to heaven."

> "You slay them all! and wherefore? For the gain
> Of a scant handful, more or less, of wheat,
> Or rye, or barley, or some other grain,
> Scratched up at random by industrious feet,
> Searching for worm or weevil, after rain!
> Or a few cherries, that are not so sweet
> As are the songs these uninvited guests
> Sing at their feasts with comfortable breasts."

But the farmers were inexorable; they preferred the discord of the locust to the music of the lark, and decreed the death of the birds, awarding a special bounty for the head of a crow. A very St. Bartholomew of birds followed; then came a hot summer, the days like coals, the ground burned to ashes, and

> "In the orchards fed
> Myriads of caterpillars, and around
> The cultivated fields and garden beds
> Hosts of devouring insects crawled, and found
> No foe to check their march till they had made
> The land a desert, without leaf or shade."

The town, like Herod, was devoured by worms, because, like him, it had slaughtered the innocents. From the trees, upon which a few last leaves blushed crimson with their shame, the canker worm dropped upon "each woman's bonnet, shawl, and gown."

The farmers saw their error, confessed it, and repealed the law, and myriads of birds were brought in cages and set free, just in time to sing at the wedding of their champion, the professor. Instances are numerous in which like prejudice and injustice have wrought repentance in a similar manner.

Professor Jenks says that, in Bridgewater, Mass., about 1820, on "election day," the occasion of the usual shooting match, birds were killed in such numbers that they were sold by cartloads to the farmers for fertilizers. The resulting scarcity of birds was soon followed by a decay of herbage and foliage. Tufts of withered grass appeared and widened into circles sere and scorched,

destroyed by the larvæ of insects. The farmers saw their error and learned a better use for birds than that of fertilization.

Flagg alludes to forest tracts in Virginia and Carolina, in which hundreds of acres were denuded by the larvæ of a species of the *Bruprestidae*, (a borer of the beetle family,) when a local warfare had long been waged upon woodpeckers, who were charged with the destruction of the trees! Misguided people! The gay-plumaged banqueters were devouring the real destroyers, as they learned to their loss.

In a district of the enlightened State of Massachusetts a gentleman shot all the robins and woodpeckers about his premises in a fit of indignation over a few cherries, mutilating his trees and violating the law at the same shot, and ultimately securing, in addition, a pestiferous abundance of bugs and cut-worms.

A farmer, observing yellow birds in his wheat-fields, growing suspicious of their actions, shot one, and wishing to prove their guilt, before executing summary vengeance upon the rest, dissected the stomach and found some wheat in which some insects had burrowed and two hundred of the destructive pests. The same short-sighted destruction has prevailed abroad. A lady in England once destroyed eight hundred birds by strychnine in a neighborhood already infested with destructive insects. In the triumph of "red republicanism" in France the people, upon the abolition of the game laws, unrestrained by fear of landowners, pursued even the song bids to the verge of extermination. The inevitable result was the destruction of the products of orchard, garden, and farm, to a lamentable extent.

A correspondent of the London Times, who had labored under the prejudice and delusion here illustrated, says: "Having my fruit almost destroyed by insects, I laid all the blame on the sparrows; but on shooting one, that was coming out of a fruit tree, a green caterpillar dropped from his mouth, and on examining its crop I found no less than twenty green caterpillars and a great number of other insects."

In Prussia, at one time, peasants were subjected to an annual capitation tax of twelve heads of sparrows; but the result of this mistaken policy, at the end of two years, proved so destructive to the wheat, which the sparrows were proscribed for eating, that the birds were invited back to the fields again.

In 1798 the forests of Brandenburg and Saxony were almost destroyed by the larvæ of *Lepidopterous* insects (moths) which found a lodgement in the branches and fed upon the tender wood. An examination by naturalists showed that the disappearance of several species of wood-peckers and titmouse occasioned the destructiveness.

Buffon tells how the Isle of Bourbon was once overrun with locusts accidentally introduced in the soil in which certain plants were budded. A few pairs of the Indian grackle were obtained (similar to our crow blackbird) with promising results. Blundering into the mistake that it was grain and not incipient locusts for which the birds were boring the soil, the colonists destroyed them all. The insects again prevailed, when the grackle were recalled, laws were enacted in their favor, physicians pronounced their flesh unwholesome as an additional protection, and the grain was saved, while the locusts were subordinated.

There are many birds with bad reputations, in popular estimation, that are deserving of consideration instead of execration. Among them is the crow. He is well worthy of defence. Hear him "for his cause." He is shy and suspicious, but frequents field and meadow, exhuming worms and larvæ with instinctive facility. His food is mainly animal, and not vegetable, and he will eat but little corn at a time, however abundant. He will follow the plough for the large white grub, the larvae of the May beetle. He is an industrious destroyer of the larvæ of the cockchafer, as is also the purple grackle, or crow blackbird, the red-winged blackbird, and the meadow lark. Crows have been

proscribed by State legislation, and insects have increased in proportion as the *corvus* family has been exterminated, the insects proving to be unendurable pests, while the bird is accustomed to take a moderate toll from the grain so well protected. The eccentric but shrewd John Randolph would not allow a crow to be shot on his farm. Counter legislation for the protection of crows has, in some instances, followed this ill-advised persecution.

The same vacillating policy has prevailed in England with the rook. Prejudice has, at times, made efforts to extirpate them there, but the multiplication of the grub and caterpillar has always brought them into renewed favor. Newly ploughed land is there frequently black with them. They become very tame under the protection of law and the toleration of farmers.

The wood pigeon has been threatened with extermination because he sometimes takes pay in seeds for the good he does. C. St. John, author of "Wild Sports in the Highlands," sought to demonstrate the utility to man of every living being, killed eight wood pigeons that were busily at work on a crop of clover; and showed that their crops were full of seeds of two of the most noxious weeds in the country—wild mustard and ragweed. Here were five to six hundred birds for two or three weeks together, during the summer, and even in winter, feeding upon the seeds of wild and noxious plants, and destroying more than human labor and diligence can accomplish. It is said that our quail answers a similar purpose.

The blackbird, so much abused, is voracious in the consumption of grubs, obtained from newly ploughed fields by a dexterous practice of boring. The cherry bird is, in cherry time, voted a nuisance, but those who have observed carefully, assert that he takes only those with worms in them. But this point will be stoutly contested by losers of cherries, and good rebutting evidence produced.

The woodpecker, poor drudge, ever digging for a living, unrespited and patient, does an important service for the farmer, as he drives into the wood his chisel-shaped bill, propelled by powerful muscles, acting upon a short neck, and with his long, tapering, needle-like tongue, extracts his chosen morsel. The catbird, much as he is disliked for eating cherries and strawberries, is still more addicted to insect eating. And the kingbird, charged with destroying bees, feeds on large flies, canker-worms, and beetles. So disgusting a bird as the buzzard is very useful, and everywhere protected by law—useful not only as a scavenger, but also, it is claimed, for the destruction of mice. The robin, coming so early in the spring, so familiar, so plump and tempting to the epicure, is often persecuted and destroyed by wanton sportsmen. He is, perhaps, the most useful of all our insectivorous birds, saving a valuable percentage of the farmer's crops by his timely assistance, and requiring immense quantities of insect food to rear two or three broods of young each season. He is by no means omnivorous, never eating corn, living upon insects, preferring the hard-shelled species for his own use, and reserving worms and larvæ for the juveniles of his family. Wilson Flagg, who has watched their habits carefully, noticed one rearing her second brood in a dry season, when berries and earth worms were not attainable, feeding her young exclusively upon cut-worms. One season he caught three young robins and experimented upon them. Two, fed upon earth worms and soaked bread, soon died. Two others, supplied only with worms, began to droop, but recovered when a portion of insects were included in their rations. The insects were killed before they were eaten. Horticulturists, near Boston, once petitioned the legislature to strike out the name of the robin from the list of protected birds. Professor Jenks, of the committee appointed to investigate, clearly proved that the bird was a benefactor. He found, from daily examinations of undigested food, not a particle of vegetable food, from early in March to the first of May. Nine-tenths of it all consisted of the larvæ of the *bibio albipennis*. From one to two hundred, in fresh

condition, were taken from a single bird. It is very destructive, feeding on the roots of plants, and injuring strawberry plats, vines, borders, &c. The fly, which is hatched in May, infests wheat and other products. The larvæ live in swarms, perforating the ground like a honeycomb, the fly depositing all its eggs in one place. The *bibio* was not found after the middle of June, worms and insects taking their place. In their season, berries are taken as a dessert; poke and alder in August and September.

HOW TO PROTECT THE BIRDS.

If the consequences of the destruction of birds are so disastrous, the wanton sportsman should be restrained, and cruel, nest-hunting boys held in check; and beyond this negative protection, actual facilities for shelter and nesting should be afforded, and practical invitations extended, prompted by more careful study and better knowledge of their habits, to the more useful of the race, to settle upon a homestead nearer to the haunts of man.

Sensible, intelligent farmers deprecate their persecution and despise the frivolous fowler that prowls about their fields, trampling the grass and cracking away at every *wren* or *martin* that rises in his path. They appreciate heartily the sentiment of Henry Ward Beecher: "The man that would shoot a robin, except in the fall, and then really and conscientiously for food, has in him the blood of a cannibal; and would, if born in Otaheite, have eaten ministers and digested them too." First in the list of protections, laws should be enacted with stringent provisions prohibiting the killing of song birds at any time, except by naturalists for scientific purposes; and wisely restricting the slaughter of game birds to such seasons as will not interfere with their propagating or with their coming to market in an edible condition. Laws looking to these objects already exist, but are defective in many cases in the time covered by the prohibition, in provisions affecting the certainty of their execution, in the inadequacy of their penalties, and in many other essential respects. Nor will the laws of one State answer as precise models of legislation in another differing in climate, the opening and duration of the bird season, the consequent time of pairing, and in other circumstances affecting the production and growth of birds. They should be carefully framed by practical observant men, with the advice of the wisest naturalists; and when enacted, public opinion should compel the strictest and most impartial execution. While we strive to prevent their destruction, the conditions favorable to their increase should be promoted and enlarged. Their accustomed haunts, food, and shelter should be preserved. Those that are wont to occupy our gardens and fields, as the wren, yellow-bird, robin, bluebird, and others, should be made comfortable by nesting boxes and trees near the farm buildings and among the fields. In the larger fields, copses of forest shade should be left here and there, with occasional trees along the walks, or a hedge for the more humble tribes. The brown sparrow, if her tastes are consulted, will be pleased with the protection of a thicket near a patch of whortleberries, of which she will partake sparingly, sandwiched with a grub. The *semi*-familiar tribes will choose a quiet retreat, in which grasses abound and vines and mosses and other cryptogamous plants are found. Among the forests thrushes, jays, finches, catbirds, and woodpeckers will make themselves at home. If a farm is laid out with reference to comfort, plenty, and rural beauty, it will have all these features, in a greater or less degree, and become a paradise for birds, a harmonious homestead in which the greatest variety is combined in the most perfect unity, and fertility and abundance crown the operations of the year.

Gardens have often been preserved from insect spoliations by placing bird-houses and other nesting places within their limits, when neighboring gardens have been destroyed. If any should be addicted to eating seed, and thus prove

troublesome, an easy remedy is suggested in the Cottage Gardener: "Moisten it with water and then dust with red lead, when neither birds nor lice will touch it." In cherry time or gooseberry or pea season, some little devices may be tolerated for frightening birds away when they incline to become too familiar or take too large a toll for their valuable service.

With cultivation, insects increase and so do birds, if fairly dealt with, especially the most valuable of the peculiarly insectivorous varieties, as the wren, bluebird, and swallow. Singing birds multiply rather than diminish as the country is cultivated.

Of game birds it is not designed to write at this time. It is a branch of the general subject, of great importance in its economic and commercial aspects, requiring the careful attention of agriculturists, sportsmen, and legislators.

DIGEST OF BIRD AND GAME LAWS.

MAINE.

In this State the penalty is one dollar for taking larks, robins, partridges, woodpeckers, or sparrows, between March 1 and July 1; and ten dollars to the owner of lands, with the liquidation of all damage suffered for any trespass committed, between March 1 and September 1, in hunting or killing the above birds.

NEW HAMPSHIRE.

The law here prescribes a fine of one dollar for killing, taking, or having in possession, at any season of the year, any robin, thrush, lark, bluebird, oriole, sparrow, swallow, martin, woodpecker, bob-o'-link, yellowbird, linnet, fly-catcher or warbler, or rail, yellowleg, or sandpiper, between March 1 and August 1. The fine is three dollars for each snipe, woodcock, or plover, between March 1 and August 1; or for each partridge, or grouse, or quail, between March 1 and September 1. One dollar additional is assessed for each bird, if taken in defiance of a published notice by the owner of the land—one-half for the use of the complainant, and the other half to the town or city. The action of the law may be suspended for one year, at any time, by vote of a town or city, so far as relates to such town or city.

VERMONT.

In Vermont the fine is one dollar in each case for taking, wounding, or killing, or for the destruction of the nest or eggs of the robin, bluebird, yellowbird, cherry or cedar bird, catbird, kingbird, sparrow, lark, bob-o'-link, thrush, chickadee, pewee, wren, warbler, woodpecker, martin, swallow, nighthawk, whippoorwill, groundbird, linnet, plover, phœbe, bunting, humming-bird, tattler, and creeper.

MASSACHUSETTS.

The penalties for the violation of the Massachusetts bird and game laws are as follows: Two dollars each for killing, at any time, robins, thrushes, linnets, sparrows, bluebirds, bob-o'-links, yellowbirds, woodpeckers, or warblers; the same for killing birds on salt marshes, the owner excepted; five dollars for killing partridges or quail between March 1 and September 1, and woodcock between March 1 and July 4; five dollars for trapping or snaring any birds at any time save partridges; twenty dollars for killing grouse or heath hen at any time, and ten dollars to the owner of the grounds and a search warrant authorized for any one suspected of the offence; and twenty dollars for hunting deer with hounds or dogs in Plymouth or Barnstable counties. There is a fine of one

dollar for killing between sunset and one hour before sunrising any plover, curlew, dough-bird, or chicken-bird. Any city or town may vote to suspend, within its limits, any of the provisions of this law.

RHODE ISLAND.

The Rhode Island law-makers have prescribed a penalty of two dollars in each case for killing, destroying, selling, buying, or having in possession any lark, robin, wood duck, gray duck, or black duck, between February 1 and September 1, or quail, partridge, or woodcock between January 1 and September 20; snipe, between May 1 and September 20; grass plover, between February 1 and August 1; grouse, or heath hen, between January 1 and November 1, and swallow, or box martin, between May 1 and October 1; twenty dollars in each case for killing woodcock between January 1 and July 1. In addition, five dollars may be imposed, to be paid to the owner of the land, for the first offence, and ten dollars for the second offence, besides a liability to damage for trespass. Action must be brought within three months.

CONNECTICUT.

A law was made in 1850, after much opposition, which has since been modified and rendered more effective. Insectivorous and song birds have greatly increased since, especially near towns and villages, and on the shore of Long Island Sound. A fine of three dollars is imposed for killing, selling, or possessing, or destroying a nest of eggs of woodcocks between the first day of February and the first day of July; pheasants, partridges, or ruffed grouse, between the first day of February and the first day of September; quails of any species, between the first of February and the first of October; wood duck, widgeon, black, gray, broad-bill, canvas-back, or teal duck. The fine is one dollar for killing, or trapping, a nightingale, bluebird, Baltimore oriole, finch, thrush, lark, sparrow, catbird, wren, martin, swallow, or woodpecker, at any time, or a robin, or bob-o'-link, between the first of February and the first of September. The taking of brook or lake trout between September 1 and January 1 is fined one dollar. It is also forbidden, under a penalty of ten dollars, to take pheasants, partridges, or quails, on the land of any other person.

NEW YORK.

The laws of New York, both local and general, relative to birds and other game, are numerous, and frequently modified or suspended. By the recent law, insectivorous and other birds are protected between February 1 and October. The fine is placed at five dollars for each woodcock, between January 1 and July 4; ruffed grouse, between January 1 and September 1; quail, between January 1 and October 20; wood, black, gray, and teal duck, between February 1 and August 1, (except upon the shores of Long Island.) It is forbidden to catch quail or ruffed grouse with a snare at any time; and it is unlawful to take prairie fowl within ten years, under penalty of ten dollars for each one killed or taken. Five dollars each is the penalty for taking trout between September 1 and March 1. A penalty is incurred of one hundred dollars and damages for putting lime or drugs in any lake, pond, or stream, by which fish may be injured. Owners of dams, if two feet or more in height, on the tributaries of Lake Ontario, Champlain, or the river St. Lawrence, are required to provide a sluice at an inclination of not more than thirty degrees, suitably constructed and protected, as a passage-way for fish.

Deer are prohibited game from February 15 to August 1, in all counties, except Clinton, Franklin, St. Lawrence, Jefferson, Lewis, Herkimer, Hamilton, Essex, Warren, Fulton, and Saratoga, (where the prohibition is taken off only in October,) and in Kings, Queens, and Suffolk, where November is the only month for their pursuit. The fine in the last-mentioned counties is twenty five dollars each For fishing, except with hook or line, in certain interior lakes,

the fine is twenty-five dollars. A similar penalty attaches to trespass in fishing, after public notice has been given.

PENNSYLVANIA.

It is forbidden here, under penalty of two dollars, to trap, kill, or shoot any bluebird, swallow, martin, or other insectivorous bird, at any season of the year, and the same penalty attaches to the destruction of eggs or nest of any of the birds mentioned in the law. A fine of five dollars is laid for killing rail or reed birds between June 1 and September 1; pheasant, between February 1 and August 1; woodcock, between February 1 and July 4; partridge or rabbit, between February 1 and October 1 and a similar penalty is incurred by buying these birds out of season to sell out of the State. The secretary of state, Hon. Eli Slifer, says: "Laws have tended to restrain men and boys to some extent, yet, I regret to say that there is room for great improvement, so far as insectivorous birds are concerned."

NEW JERSEY.

The game laws of New Jersey impose a fine of five dollars each for killing any partridge, water fowl, grouse, quail, or rabbit, between January 1 and November 1, or woodcock between January 1 and July 5; to be recovered with costs of suit, and in default of payment imprisonment for sixty days may be adjudged. A penalty of fifteen dollars is laid for placing decoys for geese, ducks, or brant, at a distance of more than three rods from ice, marsh, meadow bank, or sand bar, or for hunting them with a light at night; and it is made unlawful to kill geese, ducks, or brant between April 15 and October 15, in or about the waters of Barnegat bay, or Manasquon river. The fine is five dollars each for killing geese, ducks, or brant between April 1 and December 1, at Cape May. A trespass, after having been once forbidden to enter lands, renders one liable to a fine of three dollars. The secretary of state believes these laws "effective," though not very "vigorously enforced."

DELAWARE.

By the laws of Delaware it is unlawful for non-residents to catch or kill any wild goose, duck, or other wild fowl, under a penalty of not less than fifty and not more than one hundred dollars. Citizens do not rest under this prohibition. A warrant may be issued by a justice of the peace, upon affidavit that any person has violated this law, and the offender arrested, tried, and, upon conviction, fined not less than fifty nor more than one hundred dollars, and imprisoned until fine and costs are paid. By giving bonds in the sum of two hundred dollars, the arrested party can elect to be tried before the court of general sessions. Any boat, gun, or decoy, used in violation of this law, may be seized and confiscated, and the penalty for resisting an officer is fixed at one hundred dollars. The law does not prohibit persons from killing game on their own premises, but it is unlawful for others to kill a partridge, pheasant, robin, or rabbit, between February 1 and October 15, (in Newcastle county, between January 1 and October 15;) woodcock, between February 1 and July 1. The penalty is one dollar for each bird killed. A person not a citizen of the State, gunning upon land not his own, without permission of the owner, is liable to a fine of five dollars for each bird or other game. Some persons permit gunning upon their property; others exclude all hunters. The penalty for hunting or killing deer is two dollars.

MARYLAND.

No general law for the preservation of game or birds has been enacted in this State. Enactments of a local character have been procured, with a very limited and partial jurisdiction.

OHIO.

In Ohio the penalty is from two to ten dollars for killing, or attempting to injure or kill, at any season of the year, any sparrow, robin, bluebird, martin, thrush, mocking-bird, swallow, meadow lark, pewee, wren, cuckoo, indigo bird, nuthatch, creeper, flicker, warbler or finch, oriole, redbird, or catbird. The same penalty in each case is incurred by disturbing the nest of any of these birds; also for killing dove, wild rabbit, or hare, yellow-hammer or flicker; between February 1 and September 15. From five to fifteen dollars may be imposed for killing or hunting wild turkey, quail, ruffed grouse, prairie chicken, or wild deer between April 15 and September 1; woodcock between February 1 and July 4, and wood duck, teal, or other wild duck between May 1 and September 15. Exposing for sale or having in possession incurs the same penalties, and the costs of prosecution are in all cases to be paid by the offender. The secretary of state says the law is effective through most portions of the State; that there are numerous prosecutions, and judges usually affix the extreme penalty.

MICHIGAN.

The penalty for killing small birds is fixed at five dollars each, and for wild turkey, partridge, or ruffed grouse between February 1 and September 1; for woodcock between March 1 and July 1; for prairie chicken or wild duck, goose, or swan between February 1 and August 15; for quail between January 1 and October 1. It is made unlawful to destroy nest or eggs. The fines go to the school library fund. Indians and inhabitants of the upper peninsula are exempt from the effect of these provisions.

ILLINOIS.

Illinois has no general bird law. In a portion of the counties it is made unlawful to hunt or kill deer, turkey, grouse, prairie hen, or quail between January 15 and August 1.

WISCONSIN.

A fine of five dollars is in this State imposed for killing grouse or prairie chicken between December 1 and August 12, or partridge, ruffed grouse, or quail between December 1 and the first Tuesday of September. An exception is made for the benefit of the Indians not civilized. Half the penalty goes to the prosecutor and half to the county.

IOWA.

It is unlawful to kill or take in this State woodcock between the 1st of January and 1st of July; prairie hen or chicken between 1st of January and 1st of August, or quail, ruffed grouse, pheasant, or wild turkey, or deer, between the first day of January and 1st of September.

MINNESOTA.

In Minnesota the penalty is five dollars each for killing at any time a nightingale, whippoorwill, nighthawk, bluebird, finch, thrush, lark, linnet, sparrow, wren, martin, swallow, bob-o'-link, robin, turtle dove, catbird, or other birds; five dollars for each woodcock between January 1 and July 4, partridge or ruffed grouse between January 1 and September 1; ten dollars for trespass in sporting; twenty-five dollars for killing each deer, elk, or fawn, or having the skin of one in possession between January 1 and August 1. A fine of five dollars is also imposed for each speckled trout taken, except in Lake Superior, Mississippi, Minnesota, St. Croix, and Root rivers.

CALIFORNIA.

There is no law for the preservation of the insectivorous or song-birds. Game is so abundant that not even the boys are disposed to kill them. The destruction of hawks, coyotes, and other wild animals has caused a marked increase of small birds. In some sections quails have increased so as to prove destructive to farm crops. Wild geese, in some places, do great injury by feeding upon the young grain after it is sprouted.

A game law exists which makes it unlawful to kill any quail, partridge, grouse, or ducks between March 15 and September 15, except in St. Bernardino and Los Angelos counties. It is also unlawful to kill elk, deer, or antelopes between January 1 and July 1. A fine of twenty-five dollars is imposed for having in possession or exposing for sale such game. Fines may be laid to the amount of five hundred dollars in a single case.

DISTRICT OF COLUMBIA.

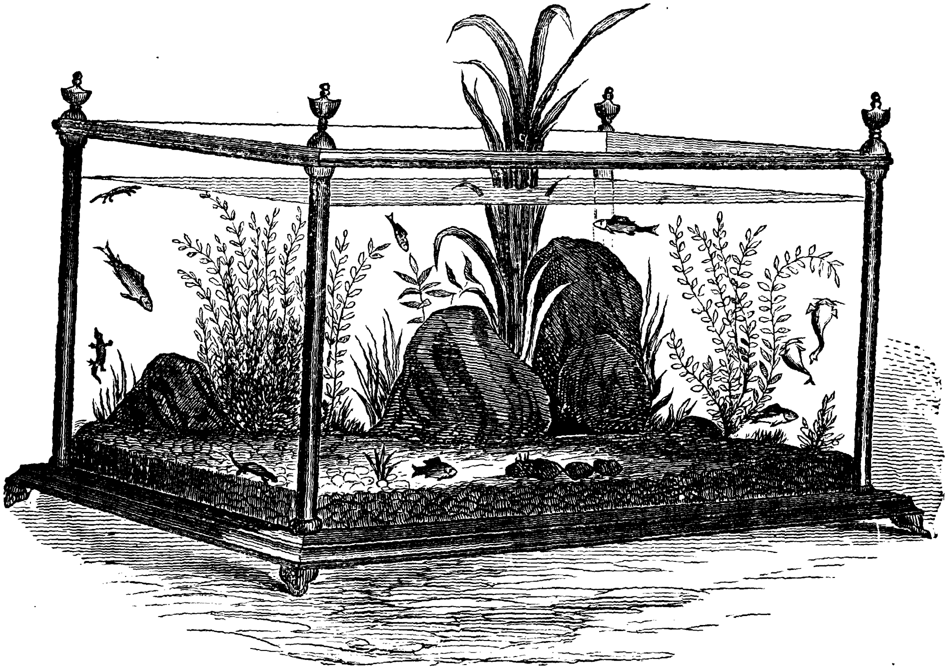
A very stringent bird law exists in the District of Columbia. In 1863 the levy court of the county of Washington (Hon. Nathan Sargent, president,) passed an ordinance "for the preservation and protection of insectivorous birds," prohibiting the shooting or taking of such birds under a penalty of five dollars for each bird so killed, possession being held as *prima facie* evidence of killing. The law confiscates the gun of any person carrying or using such weapon on Sundays. Pheasants, partridges, woodcock, snipe, rail or reed birds, and blackbirds, may be killed at certain seasons. Only hawks, crows, and owls are unprotected. All other birds not here mentioned are protected at all seasons, except the last fifteen days of the year. The rigid enforcement of this strict law has peopled the woods and groves anew in the vicinity of Washington.

FRESH AND SALT-WATER AQUARIA.

By Robert A. West, A. M., of Georgetown, D. C.

The Fresh-Water Aquarium.

The fact that "plants immersed in water, when exposed to the action of the light, emit an air [gas] called oxygen," was announced by Ingenhaus in 1778, but it was not until near the middle of the present century that this principle was applied to the aquarium. In 1842 Dr. Johnston, an English naturalist, while prosecuting experiments to demonstrate the true vegetable nature of corallines, made the further discovery that sea-water containing marine algæ remained pure almost any length of time. In 1841 Dr. Lankester established a true aquarium by keeping sticklebacks in a glass vessel with a plant of *Valisneria spiralis*, but did not then publish the fact. In 1850 Mr. Robert Warrington addressed to the Chemical Society of London a series of observations on this subject, in which he explained "the functions assigned to plants for the conversion of carbonic acid gas into oxygen, and the consequent necessity of their presence for the preservation of animal life, which would otherwise, because of the quantity of carbonic acid which it throws off, be poisoned by its own secretions." He reported having placed two small gold fishes in a glass receiver, having first planted, in some earth and sand at the bottom of the vessel, a



small plant of valisneria. This simple aquarium worked well for some weeks until the decayed leaves of the valisneria made the water turbid. To remedy this Mr. Warrington, guided by his observation of ponds, introduced into the vessel a few common pond snails. The effect was magical. The snails began immediately to feed upon the decayed vegetable matter, and the water quickly recovered its purity and clearness. In 1852 the same gentleman commenced similar experiments with marine animals and plants in sea-water, and with equal success. To Mr. Warrington, in truth, belongs the credit of first giving to the aquarium its practical form. Mr. Gosse, however, by the charms of his descriptive pen, was the first to popularize the discovery, and to inoculate the public mind of England with a passion for this purest of all household recreations. His first book on the subject was read with avidity; aquaria became parlor or library ornaments wherever a taste for natural history existed; and the directors of the zoological gardens in London and Dublin seized early upon the new discovery as a means of entertainment and instruction for their visitors. "*Punch*" levelled its keenest wit and severest satire against the new and all-prevalent mania, and ridiculed the labors of collectors and the mishaps which befell housekeepers by the breakage of tanks, to the deluging of parlor floors, and the drenching of Brussels carpets, &c. But still the passion grew. The making and furnishing of tanks became an important branch of commercial industry; one of the quarterly reviews, in the spring of 1857, remarking that "the demand for aquaria has created a new class of dealers in marine stores." There are, in fact, at the present day in London and in some of the larger towns of England, several extensive establishments engaged exclusively in manufacturing tanks and supplying salt and fresh water stock for them. Mr. Lloyd, of Portland Road, Regent's Park, London, is said to keep constantly on hand, in fifty large tanks and innumerable smaller vessels, at least fifteen thousand specimens of salt water animals alone. Over his counter sea-water is sold by the pint, quart, or gallon as commonly as milk or London porter at other places. He has a large steam factory for the manufacture of tanks, and employs uninterruptedly fourteen persons in collecting marine objects, besides purchasing largely from amateur collectors. A leading English periodical reports that "from Dover, along the entire south and west coasts of the ocean, to Solway Frith, there is not an important locality that does not contribute to his store." Others are engaged in the same business upon a scale of little less magnitude. Mr. P. T. Barnum, of the American museum in New York, was the first to introduce (in 1856) these "ocean and river gardens" to the public of the United States, though Mr. Cutting, of Boston, had previously established two small but perfect aquaria at his private residence. Being in London, Mr. Barnum obtained the permission of the directors of the Zoological Gardens for two of their curators to accompany him to the United States. He also purchased several tanks which, with a handsome stock of sea-anemonies and other marine animals, he shipped to New York, and commenced at his museum an exhibition that has proved both attractive and remunerative, and has been kept up with commendable liberality. He has sent out three separate expeditions to the Gulf of Mexico for tropical fish, and one to Honduras. Though in all this there has doubtless been more of the showman than of the ardent lover of natural history, his exhibition has awakened so much interest that aquaria are now quite common in the large cities of the north and east, and the taste for them is on the increase. In the city of New York one establishment, that of Mr. B. Greenwood, of Broadway, does quite an extensive aquarium business, though the proprietor confines himself exclusively to fresh-water stock. The aquaria and stock are transported to the far west by the various express companies, whose agents give all needful attention to the stock while *in transitu*. Indeed, there is good ground for hoping that the aquarium will become an "institution" among the families of the United States.

A *tank* is any rectangular receptacle for water, plants, and animals; while an *aquarium* is such a vessel fitted up and inhabited. With respect to the *form* of the tank there has been considerable controversy. When first introduced the depth was greater than the width, and equal to rather more than half the length. Tanks are now made much shallower than formerly, with advantage, no doubt, to aeration and consequently to the health of the inmates. For a tank two feet long the present breadth is about eighteen inches, and the depth fourteen. Mr. Wm. Saunders, the able superintendent of the experimental gardens in Washington city, has one in one of his conservatories which may be regarded as perfect in its proportions. Mr. W. Alvord Lloyd, of London, has patented a tank which is much praised by some English aquarianists. It has opaque back and ends, (the preferred material being slate,) and there is an additional back in the inside, which slopes from the top to the bottom at an angle of about twenty-five degrees. The space between the two he calls a "dark chamber." Into this the water, but not the animals, is admitted.* *It is the only form of a tank for which Mr. Lloyd has a patent.* It is quite safe to say that the arrangement is more fanciful than practically important. Opaque or slate ends are, I think, better than glass, and the emerald, velvet-like appearance, which the growth of conferva soon causes them to assume, adds greatly to the beauty of the aquarium. But aquarianists are not indebted to Mr. Lloyd for this discovery. Against his "patent tank lies the very serious objection that it diminishes the quantity of water by at least one third; and a common tank can be wholly or partially darkened without any abatement of its interior capacity. If the situation in which it is placed admits too much light, so as to cause too rapid a growth of conferva, the evil can be remedied by covering the back (and the ends if they too are glass) with dark colored paper or muslin, and the amount of light may be regulated by the depth of such covering; while, by removing it, the light may at any time be readmitted, so as to give the spectator a view of the plants and animals when thus illuminated—two decided advantages over the permanently opaque back.

In addition to the tank, the aquarianist should provide himself with a few feet of India-rubber tubing, to serve as a syphon to draw off the water when necessary, and to remove any sediment; a glass tube for dipping out any semi-liquid, or any small, offensive object, and which is thus used: Place the finger or thumb on the top of the tube before inserting it in the water; place the tube directly over the object to be removed; lift the finger, for a moment, and the object will rise into the tube with the rush of water, and can then be easily withdrawn. A pair of wooden forceps to remove any larger body or solid substance, and which any one can make for himself out of a piece of hickory wood; a sponge-stick, to wipe from the glass any confervoid growth; and a small hand-net, with fine meshes, for taking out any of the animals it may be desirable to remove. I use one of my own manufacture, substituting mosquito netting for the fine meshes. Nothing more is necessary, though experience will suggest the utility of other similar simple instruments. A syringe for aerating the water is recommended by most writers, and was formerly deemed to be indispensable. I long since discarded it as of little or no utility, except in the case of very shallow tanks, and these, in ordinary circumstances, need no such aid. When an aquarium is out of order—when the

* Mr. Lloyd claims the following advantages for this "dark chambered" tank: "while this aquarium remains in good condition the advantages are those of *passive* contact between the water in the front and the back chamber. If, however, the water in the front chamber should become slightly foul, it and the pure water in the hinder chamber may be made to exchange places *actively* by a small pump through an orifice left for that purpose. If also, by excess of light, the water should become green a similar interchange may be made, and as the hinder portion contains no organic matter, and has no light admitted to it, any water placed there rapidly becomes deodorized and colorless." It would be easy to show the fallacy of this statement.

water becomes milky or yellow, and the fishes come to the surface to breathe oxygen—the mischief lies deeper than any syringe will reach; but the remedy then is very simple. The water need not be thrown away, which might be inconvenient, and, in the case of salt water, expensive. Let it be syphoned off into shallow vessels—the animals may be placed in the shallowest of them—and exposed for two or three days to the action of the atmosphere, and it will purify itself, the oxygen of the atmosphere decomposing the carbonic acid gas, which is the cause of the mischief. Writers differ as to the best exposure for the aquarium. Some English authors favor a northern aspect, but the majority are in favor of an eastern one, which agrees with my own not inconsiderable experience; though Mr. Hibbard is correct in saying, that from May to October a northern aspect is not open to serious objection. The worst, all things considered, is a southern one. Mr. Edwards, of New York, in his excellent volume on "Life beneath the Waters," thinks a western exposure the worst.

With respect to the form of tanks, it may be added that though I have only spoken of the rectangular or square-sided tank, there is scarcely any limit to the kind of vessels that may be converted into aquaria. An earthenware bowl of any size; a common bell-glass, inverted and fixed in a wooden stand; a glass basin; a confectioner's glass jar; a tumbler or goblet; or even a wine-glass or small phial, have been made available, especially for marine aquaria, which afford a larger range of almost stationary animals, such as sea-anemonies, serpulæ &c., to whom capacious dwellings are matters of no moment. One of the most perfectly-working aquaria I ever possessed is now before me in the form of a confectioner's glass jar. It has stood more than a year without any changing of the water, remaining perfectly clear and sweet, and the animals are healthy and happy. Mr. Humphreys, in his charming book on "River Gardens; or, Home Culture of Fresh Water Plants," thus describes a bell-glass aquarium in his keeping: "A common bell-glass, inverted, is mounted upon a turned wooden stand of the simplest design. One of the projecting pieces of rock-work, the highest and driest, has been planted with a small root of fern, belonging to the more dwarf and delicately foliaged kinds; the other has been made the receptacle for a fine tuft of forget-me-not, a plant which never flourishes so luxuriantly as when its roots find their way into the water." William E. Damon, Esq., of New York city, probably the most accomplished and enthusiastic aquarianist in the United States, has had several of these smaller marine aquaria in perfect working order for two years.*

It will occur to any intelligent person that the rock-work of a large tank, judiciously arranged, may be made the home of several beautiful ferns, mosses, and small plants that frequent the neighborhoods and margins of ponds and brooks, adding greatly to the beauty and the scientific value of the aquarium. Cavities may be formed at the top to be filled with earth for those plants that require it.

Clear spring or river water is best for aquarian purposes, but pump water will answer well if the plants are allowed sufficient time to aerate it before the animals are introduced. The water will become soft. Potomac water is objec-

* As an illustration of what may be effected in the keeping of an aquarium by a gentleman who attends successfully to important commercial business, but cultivates nevertheless a refined taste, I may mention that Mr. Damon has, at this time, a marine tank in most perfect order, the water in which has not been disturbed for twenty-three months, and which, in a note to me, just received, he says improves every day in beauty and interest. The tank holds just six gallons, and the aquarium contains a dark crimson anemone, brought by Mr. Damon from the Bermudas more than two years ago; a group of serpulæ; some small white anemones; tubularia; barnacles; hydractinæ; shrimp; a small sand crab; neris; buccina; and twelve varieties of algæ. Mr. Damon has been probably more successful than any other gentleman in keeping sea-horses in aquaria. He could, if he would, give more information respecting the habits, food, &c., of those curious creatures than any living naturalist.

tional because of the earthy matter it deposits. An aquarium is said to be "working well" when the water is clear, has a bright, sparkling, living appearance, and infinitessimal globules of air (which are oxygen) are seen to ascend from the plants under the action of light. The limited supply of oxygen in the still water of an aquarium will support only small fishes, and if large fishes are to be kept, artificial aeration must be resorted to. Some years ago Mr. Cutting, of Boston, invented and patented an apparatus for this purpose, similar to a gasometer, with India-rubber tubing (having stop-cocks) leading into each tank, and concealed under the pebbles and among the rocks. Such an aerometer is in constant use in the aquarial rooms at the American Museum, in New York, and enables the proprietor to keep many large and beautiful fishes and other animals that otherwise would perish in a day or two. The effect of the stream of air broken into countless globules by the pebbles and the angles of the rocks is surpassingly beautiful. But after a long trial of such an apparatus I found that, although it produced perfect aeration, it was decidedly unfavorable to the growth of plants, and I abandoned it for the natural process of oxygenation. It is prudent, I might say necessary, to let water stand in the tank a few days before the latter is finally given up to its proposed inmates. If any oily scum rises to the surface, the vessel is not yet fit for use, and must be emptied and refilled until this scum wholly disappears. If, however, sufficient time is allowed for the thorough drying and seasoning of the cement, (the "aquarium cement" prepared by Mr. Davis, of New York city, is the best I have ever found for fresh-water tanks; it is sold by Mr. Greenwood, of Broadway,) this difficulty will not occur. When the tank is at length ready for fitting up, the bottom should be covered with small pebbles or gravel, to the depth, in a moderate-sized tank, of from two to three inches. Earth is unnecessary, as water-plants, with the exception of lilies and one or two of those growing only partially submerged, derive their nourishment from the element in which they grow. The mud is but an anchorage ground for them. Many aquatic plants do not even require this, but grow floating. A bed of gravel or pebbles is preferable to one of sand for several reasons; principally, however, because the sand becomes compact under the pressure of the water, and the small particles of decayed vegetation and the excrements of the fishes remain on its surface to the disfigurement of the aquarium, whereas they disappear in the interstices of the pebbles. The latter also soon become coated with confervæ, and are then both ornamental and useful. Rocks are next to be added. Some English writers of note object to rocks in a fresh water aquarium. Mr. Sowerby, in his "Popular History of the Aquarium," says: "In marine tanks only is rock-work admissible." Are all the English streams mud-bottomed? If only fishes proper are to be kept in the "river garden," rocks may, perhaps, be dispensed with, though even fish take great delight in loitering in their friendly shade, and certainly their absence detracts from the picturesqueness of the view. But crayfish, tritons, the beautiful little water-snake, and other prized inmates of the miniature pond, require a rock projecting above the water, upon which, by day and night, they will frequently bask for hours. Indeed, Mr. John Harper, of Edinburg, in his most charming publication, "The Sea-side and Aquarium," mentions that the blennies (a small salt water-fish) in his aquarium would lie for hours on a ledge of rock quite out of the water, motionless, as if sound asleep. Of a sudden, giving a peculiar twist of the tail, they would spring into the water and roam through it with apparently new zest. And if salt water fishes have this faculty and habit, it is neither impossible nor improbable that the piscatory denizens of the fresh-water tank may similarly indulge themselves when fully accustomed to their new home. To my knowledge it is no uncommon thing with dealers in aquarian stock to find that golden carp leap out of their reservoirs during the night, and in the morning are found "low and dry" on the floor of the store. At first, from their shrivelled ap-

pearance, they were thrown away as dead, but it was accidentally discovered that when returned to the water they soon became quite as lively as their more contented fellow-fishes who had not overleaped the bounds of their prison. However, the rock-work for a fresh-water aquarium should be kept within-bounds. Groupings of sea-shells, branches of coral, &c., are manifestly incongruous, and should, therefore, never be allowed; and it should always be borne in mind that "the more rock, the less water."

In the introduction and grouping of the plants there is room for the display of much taste, though utility—the capacity of the plants for evolving oxygen—should be the first consideration. It must be kept in mind that the purpose of vegetation is to decompose the poisonous carbonic acid gas thrown off by animals, the carbon being absorbed into the substance of the plants and the oxygen being set free for the use of the animals. Modern experience has greatly reduced the number of plants necessary to proper aeration. The confervæ, and minuter vegetation indigenous to the aquarium, are now generally regarded as all-sufficient for the production of oxygen. My own observation and experiments confirm this view. Yet, I have not been able to bring myself to dispense entirely with the larger and higher order of plants, for though their decay occasionally produces disfigurement, nothing can be more beautiful than the submerged miniature grove in an aquarium judiciously and tastefully stocked with aquatic plants. Most of these possess a considerable degree of transparency, and are exquisitely delicate when the light streams through them from behind.

Others are more nearly opaque and of the darkest green, and there is in the vegetation beneath the water every intermediate shade, from the brilliant but paleish green of the semi-transparent *Valisneria spiralis* to the opaque olive of *Potamogeton densus*. The aquatic forest may, in fact, be made as picturesque as the primeval woods or the artistically arranged shrubbery; and the velvet lawn may be added, of an intensity of green and a silkiness of texture unequalled in any other realm of nature. A piece of sandstone, or mica schist, a fragment of brick, or an earthen flower-pot, placed in a good light in the tank, will, in two or three weeks, be covered with deep emerald confervæ, that with the least motion of the water will undulate like the waves of a miniature ocean, and the air-bubles in which will be more beautiful than pearls. Unfortunately this confervoid growth will not confine itself to the rock-work, but will appear on the glass sides also, and if allowed to remain will interrupt the view of the interior. This may be prevented by passing the sponge stick over the inner surface of the glass daily, or every other day. This should be done on the first appearance of such growth, otherwise a star-shaped conferva will form, very beautiful under the microscope, but adhering so firmly to the glass that it can only be safely removed by the use of a hard brush. I have known more than one fracture to be caused by attempting to remove it by vigorous pressure by the sponge stick. Should the water itself become green by the excess of confervoid growth, it may be quickly restored to clearness by shutting out the light from the aquarium.

Of the larger plants the following are, so far as my experience goes, among the best for aquarian purposes:

Calla Ethiopica, African calla, will thrive well and flower freely, even in a small tank. But it requires considerable depth of anchorage ground, otherwise its buoyancy will lift it out of its place. When thus cared for it grows luxuriantly, forming a compact mass of roots at the bottom of the tank, and flowering freely. Even when not in flower it is highly ornamental. It may be procured at any greenhouse. *Lobelia cardinalis*, a gorgeously flowering plant, takes kindly to the aquarium *if well anchored and then let alone*. Its brilliant, intensely scarlet flower is very pleasing. It is quite common on the shoals of the Passaic river, just above Newark, N. J. *Acorus calamus*, common sweet-flag, grows rapidly in the tank, sending up its erect blades to a great height. I have

had it four feet high in quite a small aquarium. It is very tenacious of life, and only requires to have its root securely held to the bottom. *Alisma plantago,* great water plantain, when finely grown, makes a very handsome centre plant, but is too large for most aquaria. *Sagittaria sagittifolia,* arrowhead, is an elegant plant, and admirably adapted to the aquarium. It is common in all ponds and streams. Its leaves are shaped like barbed arrows, (whence its name,) of a bright green, and the flowers rise in the form of a pyramid above the water on fluted stems. They are three-petalled, white, with a flush of violet towards the centre. The plant is bulbous-rooted.

None of the above grow entirely submerged, and all are suitable only for the larger aquaria, or for use singly for centre-pieces for small tanks. There is an objection, however, to the use of such central pieces in any small, or even moderate sized aquarium, which experience has taught me, but which I have not seen mentioned in any of the books. Newts and crayfish will climb up their luxuriant stems in "the silent watches of the night," and, falling over the sides of the tank, become a prey to feline vigilance, or wander irrecoverably from their adopted homes. Of plants which grow entirely submerged, those of naturally larger growth readily adapt themselves to the limited area of the aquarium, and become comparatively dwarfed in size. Because of the operation of this law, *Valisneria,* the *Potamogetons,* and some kindred plants, are suitable for small as well as large tanks.

Unquestionably, the best plant for the aquarium, especially as regards its healthy growth and its oxygenating quality, and not the least beautiful by any means, is *Valisneria spiralis;* and, fortunately, it is quite common. It is abundant in the Potomac, and in almost all tidal streams. In the Hudson and Passaic rivers its tape-like leaves are not unfrequently six feet long. It is a native of Italy, (which possibly accounts for its adaptability to the generally higher temperature of the aquarium,) and is named after an Italian naturalist, Valisnei. In the Potomac the fronds rarely exceed three feet or three feet and a half in length. On the roots being transferred to the aquarium the leaves may be cut down to any length desired, and in its subsequent growth the plant will adapt itself to its new habitation. The leaves should be left long enough, however, to float on the surface, as they form a grateful shade for the fishes and a home for countless infusoria on which they feed. Valisneria is a diœcious plant, the male and female flowers springing from separate roots. The latter are borne on long spiral footstalks and float on the surface, adapting themselves to tidal fluctuations; the former grow on short, straight flower stems, and when matured rise to the surface, float among the latter and impregnate them. The female flower then descends in the form of a seed—the germ of a new plant. It is also propagated by lateral shoots, and seems to prefer this mode in the aquarium, possibly in consequence of its confinement within narrow limits. It flowered freely with me about the middle of September in a tank measuring only twenty inches long, twelve wide, and twelve deep, and propagated itself rapidly by offshoots. Some two years ago I had it in flower in a large tank, holding more than a hundred gallons; but I never knew it mature its seed in such confinement. It propagated itself so freely, however, by offshoots, that I regard with no surprise Mr. Alvord Lloyd's statement that from six small roots he raised thirty-two healthy plants in one season. It seems at home in the smallest vessel, and is healthy and flourishing in the glass jar to which I have referred. *Potamogeton densus, P. natans,* and *P. crispus* are all graceful and useful plants. Mr. Edwards, in the volume previously mentioned, says that there are twelve species growing in this country, but that neither of the two English species (*P. crispus* and *P. densus*) are found here. I respectfully submit that they are both to be found in the Passaic river—which, in my judgment, is richer in aquatic plants than any stream I ever visited—and in the Potomac. What I recognize as *P. densus* is also not uncommon in the neighborhood of Boston. The two

differ somewhat in their choice of location, *P. crispus* preferring to be nearer to the ocean. If I am right in my identification of these three species, *P. densus* has plume-like fronds of very deep green, and is perhaps the most opaque of all aquatic plants. *P. natans* is desirable for the aquarium mainly because of the shade supplied by its clusters of oval-shaped leaves. *P. crispus* is an exceedingly beautiful semi-transparent plant, the leaves of which are of a light olive green. *Myriophyllum verticiolatum*, whorled water mill-foil, is one of the most graceful aquatic plants known, and is quite at home in the aquarium. It is, indeed, a habitant of deep and *still* water. Though an annual, it will perpetuate itself in the "river garden" without the bestowment of any care upon it, the seed floating on the surface of the water all winter. In the spring it falls to the bottom of the tank, and the new plant is rapidly developed. What I have called the seed, however, on being dissected, seems to be a whole plant compressed into a ball about three-eighths of an inch in diameter, which remains of a dark green through all changes of temperature, and in spring unfolds itself by a most beautiful and easily perceptible process. It sends out no roots. It affects pure fresh water only. My opportunities for research in fresh-water ponds within the District of Columbia have as yet been somewhat limited, and I have not found this beautiful plant hereabouts. *Anacharis alsinastrum*, sometimes called water-thyme, from its partial resemblance to common thyme, is well suited for the aquarium, and is very common, especially in the northern and eastern States. It is a native of Canada, and is of very free growth, as England has learned to the serious inconvenience of some of her people. It was certainly unknown in that country prior to 1842, when a specimen of it was sent to a member of the Cambridge Botanical Society. It increased so quickly that a portion of it was thrown into a drain leading into the river Cam, in which river it now seriously interferes with the boating. Hence it has escaped into the Thames, where it has become one of the most troublesome of aquatic plants. It is found in the Potomac, there being several beds of it above the aqueduct, but it is diminutive and slow of growth compared with its appearance and habits in northern waters. It improves here greatly in color when introduced into the aquarium; it is a good aerator, and very ornamental. It grows equally well whether anchored or floating, and every fragment of it is self-propagating. *Callitriche verna* and *C. autumnalis*, starwort, are very delicate and beautiful plants, throwing their pale green coronals to the surface, forming there an attractive cluster of asteroids. They bear a small flower of snowy whiteness, and frequent meadow streams, or at least such is their habit in the north, and love to nestle in a bend of the rivulet under the shade of a tree. Unfortunately, the fishes, the gold and silver carp especially, are apt to strip them of their pretty foliage, and otherwise mar their beauty. *Hydrocharis morsus rani*, frogbit, is found in the more northern States. It is known here as *Limnobium spongia;* I have been assured that it is not uncommon in New Jersey, but I have failed to find a single specimen. *Hippuris vulgaris*, mare's tail, is not common here, but I found an imperfect specimen the other day in the Potomac. There are other aquatic plants available for the aquarium among those growing entirely submerged, but the list is already long enough. The water-soldier, or water-aloe, (*Stratiotes aloides*,) is much prized by English aquarianists, but after some years of search I have failed to find any plant in our waters answering the description given of it in English books. Mr. Edwards, already quoted, says it is common here, but he does not name any of its haunts.

I must not omit mention, however, of some of those minuter forms of aquatic vegetation which are alike ornamental and useful in the aquarium—the *Nitella* and *Lemna* tribes particularly. *Nitella flexilis*, flexile nitella, is a beautiful cellular plant common around New York. The circulation of the sap in its cells can readily be observed under the microscope. *N. translucens* is scarcely less beautiful, and both are good aerators. *Lemna trisulca* makes a rich emerald

carpet for the aquarium, while *L. minor* (common duckweed) forms a canopy of lighter green. The conferva known to all still waters, and regarded as unsightly, is one of the best aerators we have, and seen in the tank with the light streaming through it, and formed, as it often is, into graceful arches and festoons, always excites admiration. This minuter vegetation will only grow in its full beauty *when the tank is left undisturbed.* Then numerous minute parasitic plants and polypi will also appear, to the great delight of the student and lover of natural history.

As a general rule the water-lilies do not thrive in the aquarium. They seem to be an exception to the rule governing other aquatic plants, and derive their nourishment in some degree from the earth into which they strike their roots. In a large tank I grew the great sweet-scented pond-lily in perfection, but the root was planted in a flowerpot filled with earth (covered with pebbles to the depth of an inch to prevent disturbance of the soil) and concealed behind the rock work. Allied to the lily family is the *Brasenia peltata,* water-shield, which does moderately well in the aquarium, and is very handsome.

A tank is generally fit for the reception of its animal inmates in from three days to a week after the introduction of the plants, but pond snails may be introduced simultaneously with the vegetation. The utility of these molluscs as agents in keeping down confervoid growth is denied by some late English writers. My experience, however, is directly opposed to this new theory. A tank which I had given up exclusively to a pair of sticklebacks, engaged in the interesting process of nidification, and which I was unwilling in any degree to disturb, had become completely obscured by this confervoid growth, and even the plants were covered with it. Otherwise the aquarium was in excellent condition, and the water had not been changed or even drawn off for more than a year. During an afternoon's exploration of the Passaic river, above Newark, N. J., I had collected a large number of snails of different species, and as the most convenient receptacle threw them into this tank. In a few days glass and plants were thoroughly cleaned. Of the kinds most valuable for the aquarium are the *Physa,* the *Lymnea,* the *Planorbis,* and the *Paludina.* The *Physa fontinalis* is an excellent cleanser. Of the second genus *Lymnea columella* and *L. fragilis* are the best. Both are quite plentiful in the Potomac, the Chesapeake and Ohio canal, and Rock creek. The first-named species, which can readily be found among the *Valesneria* along the margin of the river, has a lighter-colored shell and is a very beautifully marked mollusc. The *Planorbis* is a handsome snail, especially the larger species. In form it resembles the *ammonites* found among the fossil shells of a former epoch in the world's natural history. Wyatt, in his valuable hand-book on conchology, enumerates twenty-two species. Of these, *P. bicarinatus,* small, but very pretty, is plentiful in the canal above the aqueduct bridge. There is a much larger species (*P. trivolvus*) that is quite abundant in the ponds of the north. *Paludina vivipara* and *P. achatina* are also very ornamental molluscs, and good workers. Seen only in their native homes, fresh-water snails seem to possess few points of attraction. In the aquarium, however, they well repay close observation. The *Physa* and *Lymnea* have a curious habit of floating on the surface, with the shell downwards, propelling themselves by the oscillatory motion of a fringe-like apparatus that encircles the body. The *Planorbis* has the faculty of adhering to the smooth glass, or to a rock, by the flat side of its coiled shell, without any visible means of such adhesion. All the kinds multiply rapidly in the tank, attaching their eggs by a transparent substance to the glass or plants. The earliest movements of the young snails are thus easily watched. A single snail will deposit nearly a thousand eggs during the season. It is worth while to have a small tank devoted to molluscs and small aquatic reptilia, &c., for if the snails prove ever so prolific, few of them will survive the voracity of the fishes. There will be alarming tables of infant mortality. The most curious and interesting ope-

ration of these molluscs is that by which they clean the confervæ from the sides of the aquarium. It can be observed very plainly by the aid of a common magnifying glass. The animal puts forth its proboscis, turning it inside out, as we do a stocking, until the silky surface, which is the tongue, comes in contact with the glass. Here it makes a sweep, like the mower with his scythe, taking up in its swath all the confervæ on the spot. The proboscis then enfolds its walls, and the tongue, bearing upon it all the vegetation that has been collected, disappears in the animal's interior. A forward movement is then made, and another portion of the glass is swept clean by the same process, and thus the track of the snail upon the glass may be traced as distinctly as that of the mower by his swath along the meadow.

Fresh-water mussels are generally prized for the aquarium, and are supposed to act as filterers of the water. But I much doubt their utility in this respect. They are, however, very desirable as inmates, for they will live through whatever misfortune may befall the tank, and there is nothing more beautiful than the pearl-white mantle that it will very often display. The *Unio radiatus*, common in the waters of New Jersey, surpasses even tropical shells in its rainbow-hued beauty of coloring.

Next in order are the *crustacea*, which, in fresh water, however, are not a large family. Most prominent among them is the crayfish, (*Astacus bartonii,*) which is quite common in shallow streams, but delights most in those having pebbly or rocky beds. It is naturally very shy, and can rarely be found except by turning over the stones under which it hides by day. It roams freely at night in search of prey, taking, I suspect, from experiments I have indulged in, considerable journeys from one stream to another. Unlike the English species, (*A. fluviatilis,*) which grows large enough to become edible and a marketable commodity, ours never exceeds three inches in length, and is seldom found so large. (By the way, the passion for aquaria has made our species at least *marketable*—dealers in aquarium stock paying three dollars and four dollars per hundred for them, to the great satisfaction of youthful collectors.) The large ones, as a rule, take better to the confinement of the parlor-garden than the smaller or younger ones, which may be accounted for by the fact that these veterans are found in ponds or *still* water, rather than in running streams. Crayfish of any size will, however, live very well in the aquarium if they are provided with projecting rock-work, upon which they can climb at night. In a tank in which I have several, I have found them congregated upon such a rock at all hours after sunset. The habits of this creature are very interesting. The only trouble with it is, that it is so fond of labor that it often uproots the plants. It will build itself a cave most ingeniously of the pebbles at the bottom of the tank, lifting stones that are much heavier than itself, and with its massive claws building a wall in front of its den. Like its congeners of the ocean, it sheds its whole shell periodically. One that I now have performed this mysterious operation on the 10th of September. It then remained concealed about two days, when it came out in the evening in search of food, being all attention when I approached to feed it, as usual, and menacing the goldfish and dace with its huge claws, until it had secured its portion, then hurrying off to its den to feed at leisure. Messrs. carp and dace were not sorry to see it march away. The fresh water shrimp (*Glammarus minus*) is a good scavenger, as are, in fact, all *crustacea*. It inhabits running streams, but cannot be said to be common. In the streams it frequents, it is only to be found by diligent searching under stones and pieces of wood. But there *is* a little creature (*Branchipus stagnalis*) resembling the shrimp in some repects, to be found at the bottom of almost all stagnant ponds, which deserves a home in the aquarium. It does not show itself very conspicuously, but occasionally hurries across the tank, swimming on its back, and making very ludicrous movements.

Coming to the reptiles, the triton or newt (vulgarly called water lizard) should

never be omitted from the aquarium. There are two suitable kinds. The larger, the skin of which is tuberculated like that of the toad, is called *Triton cristatus*. The skin of the other (*T. punctatus*) is smooth. It is much the handsomer of the two, and is greatly to be preferred for the aquarium. The back of this is olive brown, with black spots, and the abdomen, for its whole length, is yellow, spotted with vermillion. It is also less shy than the *T. cristatus*, and less prone to conceal itself. Its antics are grotesque and amusing beyond description—now sitting erect at the bottom of the tank, as pet dogs are taught to do when asking for a tit-bit of food; now remaining motionless midway between the bottom and the surface, "treading water," like expert swimmers, and anon dashing rapidly about in every direction as though positively demented, or reclining luxuriously on a projecting rock for hours together. It is also easily tamed. It has a curious habit, which I have more than once seen indulged in, of sloughing off a complete outer skin, and straightway swallowing it; a very ingenious and inexpensive method of foraging. The newt is very intelligent. It is also quite hardy, becoming readily acclimated in its narrower home, with its varying temperature. Intense cold seems to affect it very little. I have had it frozen, embedded in the ice of a tank, carelessly exposed during the night at an open northern window, and when thawed out Mr. Triton seemed to think the whole thing a very good joke, judging from his frolicsomeness and activity. A high temperature, however, such as the goldfish luxuriate in, is distasteful to the newt, and when that misfortune overtakes him, he spends most of his time out of the water, upon the projecting rock, greedily inhaling the pure oxygen of the atmosphere. Another beautiful and common variety is the red salamander (*Salamandra rubra.*) It is beautifully spotted with black, and its hues contrast finely with the emerald herbage among which it loves to lurk. It is somewhat shy, however, and has none of the mirth-provoking movements of its more sober-colored *confreres*. The common tadpole is a far more interesting creature than is generally supposed. It is quite active, and its motions are a singular combination of awkwardness and freedom. It has also great value as a scavenger. The imperfection of its gills compels it to rise frequently to the surface to breath, which it does with a rapid, wriggling, zigzag motion, like that of an unsteady kite. The change it undergoes, before it enters upon the full dignity of froghood, can be perfectly observed in the aquarium. I have repeatedly seen the process. The hind legs are invariably the first to appear, and sometimes there is an interval of two or three weeks before the fore-legs burst through the skin. Afterwards the metamorphosis is rapid; the tail is absorbed, and the perfect frog is formed. This soon leaves the water, squats awhile on the projecting rock, and before you are aware of his new-born love of freedom, has overleaped the confines of his prison and escaped.

The aquatic larvæ supply many interesting subjects for the aquarium. But if we wish to observe correctly their remarkable habits and transformations, we should give them a home of their own—a tank to themselves—or they will fall a prey to the voracity of the fishes. The caddis worm, the larva of the order of *phryganeæ* is first among these, and its habits are worth very close inspection. By means of a silky secretion it forms for itself a sort of sheath or case, consisting of bits of wood, small pebbles, sand, portions of leaves, and fragments of the shells of water snails. Protruding the forepart of the body from this singular tenement it crawls all over the aquarium moving with far greater activity than would be supposed. It is very voracious, however, and carnivorous in its appetite, and is only tolerated in the aquarium because otherwise we could never know its wonderful powers. Mr. Edwards justly says that "without the glass sides of the aquarium we would not be able to see the caddis worms build their grottoes and go through their metamorphoses. They are funny fellows, these cads. I have some that have cases built by laying three sticks across each other, so as to form a triangle; upon this another tri-

angle of sticks is built, but a little shifted; the next a little more so, and so on, until we have a case with a rough and pointed exterior covered with projecting sticks, but of a comfortable and beautiful smoothness within. I have others that have five-sided cases." He adds, that "instead of forming their cases of leaves of sombre brown hue, they will make one-third of its length of dark colored leaves, the next of light colored, and the next of green." In this latter remark Mr. Edwards has, I think, judged only by what he has observed in his aquarium. I have seen them by hundreds in streams, and have captured not a few, but uniformly found the case of a color most nearly resembling the mud at the bottom of the brook. In the aquarium the case will be repaired or patched with green, no other color being at hand. I have watched diligently the making and repairing of the cases, but the exact *modus operandi* remains as much a secret to me as ever. No skilful tailor ever made repairs so neatly as Mr. Caddis. The patch appears to be first stuck on from the outside, the adhesion being in the centre only, and the edges very perceptibly standing off from the garment under repair. But the worm works from the inside, and in a very brief time the new piece is so perfectly interwoven with the old that, with a powerful magnifying glass, not the slightest seam can be discovered. When wholly deprived of his case he looks almost as forlorn and miserable as the hermit crab of the marine tank in similar circumstances.

There are several kinds of beetle which are amusingoccupants of the aquarium, but the tank that contains them, if in the parlor or sitting-room, should be covered with thin gauze or mosquito netting "soon as the evening shades prevail;" for all beetles are given to roaming by night, and are apt to shock ladies' nerves by flying in their faces, or to nestle impertinently in some fair belle's glossy hair. Some of them are too voracious to be admitted into the "happy family" of the aquarium, as the *Dyticus marginalis*, for instance, which will make terrible havoc among the molluscs. The best disposed among them are the large water beetle, (*Hydrous piceus*,) commonly known as "the harmless beetle;" the whirligig, (*Gyrinus natator*,) whose rapid and incessant combined motion on the surface of the water, his bronze casing glittering in the light, has a lively and pleasing effect; and the boat fly, (*Notonecta glaucus*,) sometimes called "the water boatman," whose movements are exceedingly graceful. His two hind legs perform the work of long sweeps, and are oar-shaped. He swims on his back, and his eyes are so placed that he can see in every direction, and if a fly alights on the water he seizes him with wondrous agility. When in the water, his body has the appearance of burnished silver. It lays eggs freely, and the young boatmen are interesting little fellows, commencing active life as soon as hatched, and, according to their size and strength, foraging as successfully as their parents.

In stocking a "river-garden" with fishes, two things *must* be borne in mind—they must not be too large, and they must not be too numerous. The losing sight of these two facts, or either of them, is fatal to the success of the aquarium, especially with regard to size. Large fishes consume more oxygen than this artificial pond can supply. Three inches should be the extreme length of any admitted into a moderate sized aquarium. Small gold fish, from their capacity to bear a high temperature, and no less for their beauty and the variety of their markings, will be the first choice of an aquarianist. But they grow rapidly, if healthy and properly fed, and must, therefore, sooner or later be parted with—a grievous trial when one has loved and petted them. The minnow, (*Fundalus fasciatus*,) lively and full of frolic, yet easily tamed; the common shiner, (*Stilbe chrysoleucus*,) a very handsome fish; the yellow perch (*Perca flavescesn*) when, and *only* when, quite small; the sun fish, (*Pomotis vulgaris*,) also only when quite small, for when well grown he will worry and torment to death the smaller fish; the pigmy dace, (*Leuciscus pigmæus*,) a beautiful little fish, not more than an inch and a half long; the black-nosed dace, (*L. atronasus*,) a beautiful little fish common to all our brooks, and distinguishable by a black band running

from the nose down each side and dividing very definitely the silvery abdomen from the olive brown back; as happy in the aquarium as a fish can be anywhere; the common sucker, (*Catostomos communis,*) when quite small; and the tesselated darter, (*Boleosoma tessellatum,*) may all, or some of them, according to the size of the tank, be brought together in peace and harmony, and will afford a sufficient variety of animated nature. The last named is a singular little fish, lying generally in ambush at the bottom of clear streams, and darting rather than swimming after its prey: I have seen it, or my eyes greatly deceived me, in considerable numbers in one of the streams running from the canal to the Potomac, near the chain bridge; but unfortunately I was unprovided at the time with means for its capture, and on a second visit looked in vain for a single specimen of it. It is worth some trouble to secure, its habits being entirely different from those of any small fish. Small eels are very graceful and elegant in the tank, but they are fatal to molluscs, as observation has repeatedly shown me. They are the worst enemies the water snails have; will seize upon the exposed portion of one, and making themselves perfectly rigid and perpendicular to the bottom of the tank, spin around with great velocity, drilling the poor mollusc out of his shell. They ought not to be admitted into a well-ordered fresh-water aquarium.

In the above enumeration I have not mentioned the stickleback, (*gasterosteus,*) because, unlike those named, which will live and thrive in fresh water only, he is equally at home in both the fresh water and the marine tank. But if you would see the male stickleback in perfection, his nest left unmolested and his numerous progeny raised in safety, you must give him a tank to himself, even relieving him of the presence of his *wives*—for this wonderful, nest-building fish is a Mormon and practices polygamy upon a respectable scale. The male stickleback is by far the most pugnacious of all pigmy fishes—though the female is meek and gentle as a lamb—and in breeding time this pugnacity is excessively amusing, and as the males then wear the gorgeous tints that will be hereafter described, some not too closely and patiently observant English writers have jumped to the conclusion that these colors are drawn out by the excitement of battle. Such, however, I am satisfied is not the case. At other times than the season of nidification, sticklebacks fight without any such exhibition of gorgeous colors, or in fact of any change of color. The "purple and gold" of which Dr. Lankester speaks, and which is but a touch of fancy's pencil, are colors *worn only in the breeding season.* In the fiercest tournaments at other times the male stickleback is not distinguishable by its colors from the female, but wears a dress that no member of the society of Friends would be ashamed of. But during nidification the color of the male is the most brilliant vermilion from the lower lip along the abdomen to the caudal fin, and something approaching ultramarine blue on the upper part of his body. Nor is it true that these colors fade if he is defeated in conflict—that "the moment he is defeated by a superior force his colors fade away into a dingy, dull white, or a common-place combination of hues of no attraction." This is romance, not natural history. If he cannot have the place of his first choice for his nest after vigorously battling for it he selects another, and is just as brilliant, and as attentive to the duties of the season as the victor is. In fact, these splendid hues come gradually, remain so long as the breeding season lasts, even though he have no mate, and then as gradually fade. They begin to appear in February, the red showing itself under the scales, first about the mouth and gills, giving the fish the appearance of having been bruised. This gradually deepens and spreads until the creature assumes the brilliant colors I have mentioned, and the eye glares with an intense bluish green light. There was an occasion, however, to be hereafter named, when the male stickleback became white as silver for a few moments.

In the spring of 1860 I procured some male and female sticklebacks, a single pair of which I placed in a fresh-water aquarium by themselves, and the re-

mainder I deposited in a large salt-water tank, which was already pretty well stocked. The males of these quietly took possession of spots eligible for their nests and commenced building. They were, however, so much disturbed, and their work was so often destroyed by the crabs and other inmates of the aquarium, that my experiment of breeding in my salt-water tank was for the season a failure. Not so in the fresh-water one. The male promptly selected a home for his expected family, taking all the labor upon himself. Here again poetry has been substituted for fact. Instead of "gently alluring his mate to their new-made home," and being "a model husband," truth compels me to say that he was the veriest of tyrants, and fiercely attacked his *cara sposa* if she dared to approach the nest during its construction. When his labor was completed, however, he as harshly attempted to drive her into it. During the progress of the building her meekness, submission, and affection were beyond all praise. She generally lay quietly in a corner of the aquarium, and when he chanced to come near her, would immediately rise up perpendicularly, quivering her fins, rubbing herself against his side, and making every possible demonstration of tenderness. All the material for the nest was conveyed by the male in his mouth. It consisted of various confervæ, stems of nitella, &c., which were placed in layers, with a mouthful of sand or fine gravel occasionally dropped upon them to keep each layer in its place; and he frequently slowly rubbed himself over the whole mass, apparently covering it with a cement exuded from his body. When completed, it was a compact nest, with a round passage through it of from one-fourth to three-eighths of an inch in diameter. Having given it the finishing touch, he sought the female to drive her in. As I was this moment watching the operation I had the rare opportunity of observing the actual depositing of the spawn, &c., of which no description has yet met my eye. The madam now acted with proverbial female coquetry and waywardness, and led her imperious spouse a chase, a dozen or twenty times around the aquarium, avoiding the nest as obstinately as she had before eagerly sought it. At length she relented, and entered it at the orifice nearest the front of the aquarium. Her caudal fin alone remained visible, and I noticed that it had an incessant quivering motion. The depositing of the spawn lasted about forty seconds, and it was while the male excitedly hovered near, that he almost literally "turned as white as a sheet." As she glided out at the further orifice, he entered and performed his functions, also passing through the nest. Afterwards he closed the orifice and commenced an assiduity of attention to the nest that was most surprising. Night and day he kept guard over it for some eighteen days, now strengthening its walls by additional stems of nitella, now thrusting his nose into the orifice to ascertain that the seal had not been violated, and every few minutes hovering over it, with his body inclined at an angle of forty-five degrees, fanning it with his pectoral fins, aided by a lateral motion of his tail. At length the young appeared, and the vigilance of M. Gastorosteus was redoubled. On the day that I first saw the young ones, which I am pretty sure was the first day of their appearance, the delighted *pater familias* would not permit any of them to leave the mouth of the nest, the orifice to which he had torn open for them. On the second day their "area of freedom" was slightly extended, but if they went beyond the limits, he would take them in his mouth, as a cat does her kittens, and put them back into the nest. After a few days, however, he no longer restrained them of their liberty. Left to themselves, they soon spread themselves over the tank. I estimated their number at more than two hundred. From the time his parental duties ceased began the decadence of the male's brilliant coloring. As for the female, seemingly conscious that her functions were entirely at an end, she lay at a remote part of the tank, concealed by a root of valisneria, never venturing near her husband and children. In fact, when the young fry began to extend their travels, and were seemingly able to take care of themselves, I removed both

the parents for fear of *accidents*, to wit, possible infanticide—a precaution I recommend in all similar cases. With such positive evidence that the *male* stickleback *alone* "attends to the little ones," I could only smile when Mr. Hancock, a naturalist of some eminence, asserted, in an interesting and otherwise very correct description of this process of nidification, which appeared in the "Zoologist," that "it required all the *mother's* unremitting exertions, for several days after the fry were hatched, to keep them within bounds, so as to preserve them from danger." Even Dr. Lankester falls into a similar error, publishing, with his indorsement, a communication from a correspondent who describes "the *mother* fish" as "continuing her attendance at the nest as long as any of the young fry were left." As the correspondent was a woman, the mistake was a natural one.

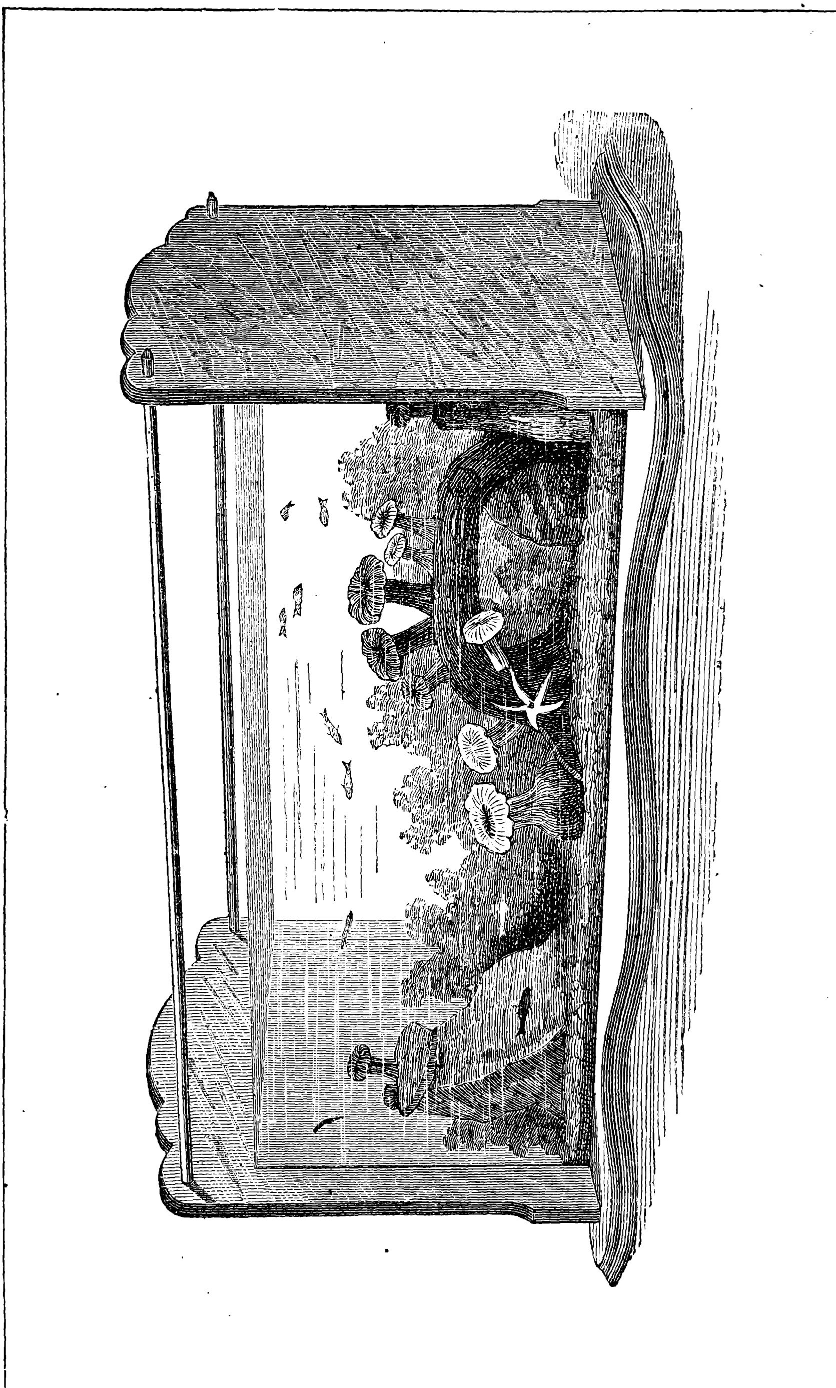
But this article has already exceeded the limits assigned to it, and I must bid adieu to this interesting and really inexhaustible subject. I would not dismiss the subject, however, without transferring to these pages the following just and eloquent tribute to the exalting influences of this new pleasure from the pen of Sidney Hibbard:

"The aquarium introduces us to new scenes hitherto hidden from our view, makes us acquainted with the economy of creatures of whose very existence many of us, not altogether unlearned in the history of the world, were previously ignorant. Their habits of feeding, of moving, and burrowing; their battles, their changes of form, the display of even a strange intelligence, working its way by wonderful means to wonderful ends, impress the observer with an idea of the boundlessness, the variety, the adaptations and resources of a world brimming with life, in all manner of strange forms and developments. Here we see them equipped and armed for battle against each other, the strong destroying the weak, yet each contributing its part to the preservation of the whole, just as in all other departments of nature the great balance of perfection is sustained by incessant and intestine war; the struggles of opposing elements, and powers, and beings, all working mysteriously in a manner independent of isolated circumstances—nature, the prodigal mother, setting no value upon individuals, but regarding tribes and races as paramount, the whole seeming confusion tending to one great end—the revolution of the mighty wheel on which the creatures are painted as signs, and in which ages are but minutes in a revolution which itself is eternity. In the midst of all its EVERLASTING WISDOM, watching, loving, and sustaining; happy we to get some glimpses of his method of working through the medium of the strange creatures which leave the mysterious deep to throw a new radiance in our homes."

THE SALT-WATER AQUARIUM.

Prominence has been given in this article to the fresh-water aquarium, partly because American and English authorities have failed to give full information with regard to it, or to do justice to it; partly because it is within easy reach of all; but mainly because I cannot yield to the salt-water aquarium the very marked preference which has generally been accorded to it. Experience and observation have taught me that concealed under the rocks in babbling brooks, hiding in the grassy margins of purling streams, buried in the depths of silent ponds, roaming in the submerged forests of aquatic vegetation, passing through strange and marvellous metamorphoses, is a multiplicity of animal life that may as profitably be the study of a lifetime as that of the ocean's depths. In botany, fluvial has the advantage in interest over the marine aquarium. Not that the sea has not, *poetically speaking*,

> "As well as earth, vines, roses, nettles, melons,
> Mushrooms, pinks, gilliflowers, and many millions
> Of other plants, more rare, more strange, than these;"



but that of the vegetable wonders of the ocean, but very few will live in the aquarium.

Undeniably, however, the marine aquarium has introduced to us many novel and curious *animal* forms. Nor is an "ocean-garden" necessarily beyond the acquisition of persons living remote from the sea-coast. Artificial sea-water may be manufactured at a comparatively trifling expense, and was successfully used in England a long time before natural ocean-water became an article of merchandise. Mr. Gosse gives the following recipe, which is preferable to all others:

Common table salt	3½ ounces.
Epsom salts	¼ "
Chloride of magnesium	200 grains, Troy.
" " potassium	40 " "

Or in a simpler form, avoiding the perplexity of avoirdupois and Troy weights:

Common table salt	81 parts.
Epsom salts	7 "
Chloride of magnesium	10 "
" " potassium	2 "

One pound of this mixture will make nearly three gallons of sea-water. It should be well mixed, in an earthen pan or jar, and allowed to stand for a week, so that any insoluble particles or impurities in the chemicals may be deposited. It should during that time be fully exposed to the atmosphere and sun, but so protected that no rain can fall into it. Before being transferred to the tank, its specific gravity should be ascertained, and should not be less than 1.026, or greater than 1.028. The rules for the preparation of a salt-water aquarium are the same as those for the fresh water one, save that marine shells may be advantageously mixed with the gravel, and more rock-work be allowed. The tank containing artificial salt water should, for a while, be exposed to a strong light, a small plant of *Ulva latissima*, commonly known as sea-lettuce, or of *Enteromorpha compressa*, having been first introduced. Either, or both, may be obtained from some friend on the sea-coast, and with several varieties of actiniæ and other zoophytes, can be forwarded by express, in a tin vessel, with a perforated lid. The small quantity of sea-water sent with them may be added to the artificial preparation with the best of consequences, even though it be only a pint or two. The scores of marine plants which it contains will, under a good light, so rapidly develop themselves as to afford the most ample aeration. As the water falls in the tank by evaporation, it must be brought up to its original level by the addition of pure *fresh* water, as the salts remain after evaporation.

With respect to the vegetation of the marine aquarium, it is, I believe, universally conceded that the only plants necessary, if not indeed the only plants useful for aeration, are the two named above. The coarser kinds, such as the varieties of the *fucus*, and the several beautiful red and pink algæ, have little or no value as aerators, and their introduction into any but perfectly constructed and highly conditioned tanks would be very hazardous. As I have necessarily but a limited space allotted to me, and am treating of the aquarium and not of the herbarium, I shall not attempt even the nomenclature of the marine algæ.

When the tank has stood a week or ten days, or earlier, if the presence of globules of oxygen shows that it is healthily working, some actiniæ or sea-anemonies, classed vulgarly as "sea-flowers," the most curious, beautiful and plentiful of the zoophytes or animal-plants, may safely be introduced. They are of all sizes, from the merest speck to six inches in diameter, when expanded. In tropical waters they are found much larger. I once possessed one brought from Key West by a friend, that measured eight inches in diameter, and in height, when in its full altitude, fifteen inches. Its base was a deep, bright orange, verging on scarlet; its stem or body of snowy whiteness; and its tentaculæ

of an exquisitely delicate lemon color. Unfortunately, when I received it my marine aquarium was not in a healthy condition, having been filled up with water taken from too near the shore; and before I could remedy the evil the beautiful stranger sickened and died. It is not easy to convey to the mind of any one who has not seen these elegant zoophytes a correct idea of their habits and general appearance. When closed, as the sea-anemone always is when out of the water, or when in the slightest degree disturbed by concussion or contact, it is nothing more than a mass of flesh, slippery to the touch, of the consistency of thoroughly wetted leather, and by no means an attractive object. The smaller kinds are abundant in the "kills" which divide Staten Island, New York, from the Jersey shore; in New York bay and on the margins of the "Sound." Fishermen, raking for oysters and clams, often bring up shells, stones, fragments of brick, &c., containing numerous specimens of them. Yet until collectors for aquaria began to show an interest in them, the most intelligent fishermen never supposed that they were living animals. I shall never forget the compassionate smile turned upon me by an old boatman whom I had employed on a collecting expedition, when I carefully picked these specimens of zoophytes from the debris and mud brought up by his oyster tongs. Every marine collector has doubtless had similar experiences. I turned the tables upon him a few days afterwards, however, by showing him these same actiniæ in full florescence in my salt-water tank; explained to him their true animal nature, and tested the voracity of their appetites by feeding them before his eyes. Almost immediately on being returned to the water, the actiniæ gradually erect the stem or body, spread their coronet of tentaculæ, and become the living flowers which Southey has described:

> "Here, too, were living flowers,
> Which like a bud compacted,
> Their purple lips contracted;
> And now, in open blossoms spread,
> Stretched like green anthers many a seeking head."

The sea-anemonies of our own waters are, as a rule, much more sober-hued than those of the British and other coasts, and vary from pure white to dark brown. Some of them, however, are exceedingly beautiful. A species common on our eastern shores has a very dark brown stem, with pure white or pale pink tentaculæ. Others common in New York bay and other localities are of a bright salmon color, marbled with brown, or white marbled with gray. The majority of these curious and elegant creatures are hardy, and all of them will flourish in a well-conditioned aquarium; though not much given to locomotion, I have known them "make good time" in travelling across quite a large tank. Their mode of travel is by projecting a portion of the base, and then contracting the other portion. English authors mention that many of them may be cut into sections, each of which will become a complete anemone; and a friend, formerly consul at a South American port, fully confirms the statement. I have never felt inclined to try the experiment, but have no doubt of the fact, for I remember that on one occasion a fine anemone had fastened itself upon the side of my aquarium, close to the surface of the water. I had occasion to use some of the latter during the evening, which left the base of the anemone nearly half out of the water. The warmth of the room, I presume, had caused this portion of the base to dry rapidly during the night, and in the morning I found at least one-third of it adhering to the glass, while the anemone had descended more than ten inches. As it still presented its base to view, I had the best opportunity of examining it, but I could not discover the smallest indication of the large rent thus made. The smaller actiniæ, however, rarely move from the spot on which they originally settle, and being stationary require very little water, provided that little is well oxygenated. I have at the present time several small, wide-mouthed glass bottles, only two inches and a half in diameter, and

but two inches deep, each of which contains two or three actiniæ in perfect health and in constant florescence, while the water is clear and bright. A small piece of *Ulva latissima* in each aerates it perfectly. The larger anemonies require feeding occasionally. The mouth, which is simply an opening directly into the stomach, is in the centre of the disk, which is surrounded by the tentaculæ. They will eat at a meal a piece of raw beef the size of a coffee-bean, seizing it with their outstretched tentacles, and gradually pressing it through the orifice into the stomach. In the same manner they will seize an incautious shrimp or small fish, swallow it, deprive it of every nutritious particle, and in a few hours eject the shell or skeleton. The following species found in American waters are, with the exception of the first, admirably adapted for the aquarium:

Actinia crassicornis, or thick-horned anemone, mouth delicate straw-color; tentaculæ, white, with bands of pink; stem, rich orange brown.

A. gemmacea, or gemmed anemone, many hued in the same specimen; mouth and points of tentacles gemmed with touches of blue, yellow, and brown; stem brightly tinted with pink.

A. mesembryanthemum, or carnation anemone, of various colors, but principally rich brown stem, with rose-colored or pink tentacles.

A. dianthus, or plumose anemone; stem of various colors, scarlet, white, orange, and light green.

A. clavata, or nailed anemone, pure white.

A. anguicoma, or snake-haired anemone; one of the most beautiful specimens on account of the extreme gracefulness of its numerous, long, transparent, twirling tentaculæ, which have the appearance of a number of delicate worms, clustering and twisting about each other. Stem, light buff, with irregular lines of brown; tentaculæ lighter colored.

A. carneola Belongs to the coast of Maine. Very small; mouth protruding far upwards from the disk, and the tentaculæ springing from its edges, instead of from the circumference of the disk.

A. obstruneata. Short-stemmed; tentaculæ short and blunt at the extremities.

A. rapiformis. Inhabits the sand on the coast of New Jersey, but is not unfrequently washed up by the waves.

A. marginata. A very common, but very beautiful, species.

A splendid ornament to the marine aquarium is a group of *Serpula contortuplicata*. The fan-like and pectinated gills of the serpulæ, with their curious stoppers and twisted shelly tubes, have a very lively and animated appearance. The tubes are found in clusters, attached to empty shells, or other substances, and from these the gorgeous scarlet heads of the serpulæ obtrude, and into them they suddenly retreat when disturbed. The mouth of the tube is slightly expanded, and the beautiful projecting fans are the animal's gills. In addition to these is a conical body on a stem, with its apex downward; and while one wonders what it is, the serpula, perhaps alarmed, instantly furls his fan and pops into his hole. Having withdrawn his breathing apparatus safely to the tube, he shuts himself in by drawing this conical body after him and closing the aperture. It is, in fact, a stopper. When first introduced into the tank the serpulæ are excessively shy, shutting themselves up if even a shadow passes across the aquarium; but after awhile they will remain constantly expanded, unless a sharp blow is struck on the glass. There is some little difficulty in acclimating them, but when once this is accomplished they will live healthily, and even carry on their building operations. I have known them to survive the severest wreck of an aquarium, and I have also known them bring utter ruin upon one, by dying in their tubes beyond observation or reach. A group sent me recently from New York served me thus, many of them having been suffocated by being thickly enveloped in *Ulva latissima*, to save the delicate edges of the tubes from fracture

Although a healthy marine aquarium, stocked only with actiniæ and other zoophytes, is a beautiful sight, and a delightful study, some persons will prefer additional animation. Let them, then, procure a few specimens of the hermit crab. There are three species: 1. *Pagurus longicarpus*, small, and very common on our coasts. It may be caught in great numbers in the spring or fall, inhabiting, most commonly, the shell of the *buccinum*, and not unfrequently that of the *pyrula*. 2. *P. pollicaris*, a larger species, and less common, is generally found in the shell of the *Furgur carica*. 3. *P. bernhardus* is the commonest species on the shores of Great Britain, but is not often met with on ours. I have, however, received specimens of it from Boston. It is the most pugnacious of the three, though they are all decidedly belligerent. The author of "Life Beneath the Waters" expresses a doubt on this point, with regard to the American species, at which I must confess my surprise. I never placed two or more in an aquarium without witnessing a fight between them; and, even in a very large tank, could never persuade two of them to remain in peaceful occupation of the same side of the vessel, though I have repeatedly made the trial.

The peculiarity of the hermit crab is, that, unlike all other crustacea, it has no dwelling that is of right—say, perhaps, rather of inheritance—its own. Crawling clumsily about, with a stolen house upon its back, it seems as if it were not in its natural condition. And yet this is the state in which it is, I believe, invariably found; and if, by any accident, it is deprived of its portable shell, it is as uncomfortable as a fish out of water; and, unless it can find another, will as surely die. Its form is aptly described as "a sort of mongrel between crab and lobster. Unfortunately for our hermit, however, unlike either of those crustacea, his tail is soft and wholly unprotected, and liable to be nibbled at by every passing fish.. Of this he is evidently painfully, almost ludicrously, conscious, and is exceedingly anxious to shelter that member. When in the unpleasant predicament of having his extremity thus exposed, he will seize upon almost any empty shell *sans ceremonie*, and it sometimes happens that he enters one that is, or soon becomes, uncomfortably tight for him, in which case he goes house-hunting, and having found a more commodious one, leaves his old casing for some younger and less corpulent brother. I have often tempted a Pagurus to change his residence, his performance of that feat never failing to amuse. I have dropped in a shell that seemed to be of convenient dimensions for him, and was of tempting exterior. By and by he would *sidle* up to it to see if the new house were to let. To ascertain this, he would put his two claws into the mouth of the shell, thrusting them far down into its cavity, and by probing ascertain whether it already had a tenant. Having satisfied himself that his right of possession "there was none to dispute," he would instantly, almost literally in the twinkling of an eye, erect his tail, whisk himself over the smooth lip of the shell into its tube, with an adroit backward movement that was perfectly marvellous; and would then look out from his new home with most laughable self-complacence. While our friend is in good health (and that depends on the healthy condition of the aquarium) he keeps a firm grip on his mansion with his hooked tail, but no sooner does he feel squeamish and sick, than he loosens his hold and crawls outside the door to die and one can scarcely conceive of a more pitiable object than Mr. Pagurus presents when in this melancholy condition—so tame, so crestfallen, so totally the reverse of the sharp, snappish, impudent style in which he usually conducts himself when at home and in good health. When in this "bad way" he must not only be immediately taken out of the tank—for, in a very short time after he becomes moribund, his carcass will spread miasma and death—but the aquarium itself must be looked to, for this voluntary abandonment of his tenement by the hermit is an infallible sign that something is wrong in the "ocean-garden." Yet in health the hermit crab is the most amusingly restless of creatures

He is perpetually roving over the tank, making vain endeavors to mount the most inaccessible places, or to climb to the top of an alga, the fronds of which will barely sustain his weight. His tumbles are innumerable; but bumps and falls he does not seem to heed. He will "come down by the run" from a treacherous eminence, roll over and over without sustaining the slightest injury, and the moment his shell is steady, put forth his head and arms with an air that plainly says he thinks he has done something on which he ought to be omplimented.

The common edible crab, (*Lupa dicantha,*) when only from one to two inches in length, is a safe and pleasing inmate of the aquarium, though apt to hide himself from view at times. He can generally be tempted from his lair, however, by dropping a little food into the tank. The fiddler crab, (*Gelasimus vocans,*) though a creeper, and not a swimmer, is also a desirable inmate; only, however, in case of there being some rock projecting above the water upon which it may crawl at its option to breathe the atmosphere. The suddenness with which it disappears when unexpectedly approached is wonderful and almost startling. The spider crab, or sea spider, (*Libinica caniculata,*) though somewhat unsightly when out of the water, has such a singular appearance and such curious habits, that it should always be admitted into the aquarium; the smaller the size the better. I have for some time had one about an inch long, the movements of which are a constant source of interest. It is exceedingly fond, as its species always are, of decorating itself with sea-weed. At this writing it has a small branch of *Delesseria sanguinea* on the top of its head, and two streamers of *enteromorpha* on its back. In a day or two these will be changed for any other gay algæ it can find. I have watched both my present specimen and others vigilantly in order to discover the manner in which the creature robes and disrobes itself, but it is reticent as any lady of the secrets of its toilet, and my wathfulness has failed of its object. The common bait-shrimp, (*Crangon septemspinosus,*) found in creeks running from the sea, and in ocean shoals, is one of the most elegant habitants of the aquarium. Its lively movements, its semi-transparent body, and its unique method of swimming, place it among the most ornamental of crustacea. A late writer on the marine aquarium is far wrong in asserting that it "cannot be kept any length of time in confinement unless the water is constantly changed." I have never experienced the least difficulty with it. A dozen of these agile and beautiful creatures lived twelve months in my tank, except two or three, whose temerity in stealing food from the anemones resulted in their becoming the prey of the indignant zoophytes. The deeper water or edible shrimp, however, will live but a few hours in this tank, which is the more remarkable as it necessarily inhabits stiller water in its natural home.

All crustacea are scavengers, but they confine themselves chiefly to animal refuse. To prevent excessive confervoid growth some molluscs should be introduced, as in the case of the fresh-water aquarium. The common *Buccinum obsoletum*, to be picked up by thousands along all our shores, is useful for this purpose. Its *modus operandi* is the same as that of the fresh-water snail already described. The European whelk (*B. undatum*) is a handsomer mollusc, but it is rare here. Its place may be supplied by the winkle, (*Pyrula canaleculata,*) or by the drill, (*Fusus cinereus.*) But the buccinum may be relied upon to do the work effectually if variety of molluscs is not obtainable. Bivalves are not safe inmates of an aquarium, though some are desirable for their beauty, and others because of their peculiar habits. The little scallop (*Pecten concentricus*) is of the former class, and will live in a perfectly healthy and well oxygenated aquarium. Mr. Damon, of New York, has perfectly succeeded in domesticating it. Nothing can be more elegant than this truly beautiful creature. A fine orange-colored fringed mantle hangs from the interior of the shell, while along its margin is a row of beautiful blue spots or beads, rivalling the torqueise in bril-

liancy of color. The pecten is, moreover, quite active, and like the English cockle (*Cardium edule*) can perform some very creditable leaps. The common mussel (*Mytilus borealis*) is chiefly remarkable for its power of attaching itself to the rocks, or even to the glass sides of the tank, by means of its bissus, formed by a number of silken threads. The soft-shelled clam is worthy of admission into the artificial rock-pool mainly for observation of the action of its syphon. It must be conceded, however, that if the scallop is to live in health in such confinement, the aquarium must be in the best possible condition; that the mussel and clam would have but an uncertain tenure of life in the tank, and that if their death should escape observation for twenty-four, or even for twelve hours, serious mischief would be certain to result.

It is unnecessary to enumerate the fishes suitable for a marine aquarium, since they are quite secondary to the many other curious and interesting objects which the sea supplies. If these are desired, however, and the tank be large enough to admit of their being added to the stock of zoophytes, crustacea, &c., nothing can well be more ornamental than the stickleback, which lives and breeds full as well in salt water as in fresh; but they, or, indeed, any fish, will drive the shrimps into hiding places, annoy to some extent the anemonies, and make havoc with the molluscs. A harmless and exceedingly beautiful fish for the marine aquarium is the sand-smelt, (*Atherina notata*,) having burnished silver scales, and a longitudinal bar of silver on each side of its semi-transparent body. It is exceedingly delicate, however, and he who would even safely transport it from its place of capture must

> "Take it up tenderly,
> Lift it with care."

I never could succeed in keeping one more than a week or two. There is a curious fish which is worth adding to other marine curiosities. I refer to the sea-horse, which is alone among fishes in having a prehensile tail, by means of which it holds on to sea-weeds or floating objects. It is from four to five inches long. The head and upper part of the body (the rest tapering off into the tail aforesaid) are the exact counterpart, in miniature, of a horse's head, neck, and chest. Mr. Edwards describes it as the "Hudson river sea-shore," (*Hippocampus Hudsonius*.) All the specimens I have seen were taken near the "Narrows," or even further from the mouth of the Hudson, and it certainly will not live in a fresh-water tank, but requires a well-conditioned marine one. Repeated trials and experiments made by Mr. Damon indicate that with great care and under very favorable circumstances it might possibly be habituated to the aquarium. It is suspected, however, of foraging upon the serpulæ, which is a grave objection to its company in the same vessel with them. Nevertheless, it is a remarkably curious animal, viviparous by the way, and any one may be pardoned for wishing to add it to the treasures of his ocean-garden. After repeated trials and failures, I have succeeded in keeping one for a year and a half *by transferring it from the tank to a phial of alcohol.*

TEXTILE FIBRES OF THE PACIFIC STATES.

BY WILSON FLINT, OF SACRAMENTO, CALIFORNIA.

THE AREA OF TERRITORY AND POPULATION CONSIDERED.

STRETCHING along the northern Pacific coast, between the parallels of 32 and 48 degrees of latitude, lie the States of California, Oregon, and the Territory of Washington, while near as well as remotely inland, and belonging to the same general climate, with social and industrial relations co-dependent upon a mutual commerce which finds its way from abroad to the port of San Francisco, are the Territories of Idaho, Utah, Arizona, and the State of Nevada. In territorial extent this region covers nearly or quite one-fourth of the area of the United States; and holding, as it does, the western outlets of the American portion of the continent, it is destined to occupy an importance in the trade with the eastern coast of Asia and the Australian Archipelago not less interesting than that which has already grown to such colossal proportions between the communities located upon the western shore of the Atlantic.

The acquisition of most of this territory, and the establishment upon its soil of a numerous population, with many of the industries of civilized life, is comparatively the work of a few brief years, as less than two decades have passed since the United States claimed possession of only a narrow strip about the mouth of the Columbia river; and this possession at that time was held more as a dependency of the British Hudson Bay Company, then engaged in the prosecution of the fur trade with the roving bands of savages, who paid more respect to the authority of the English traders than to the few Boston men who were endeavoring to plant, amid surrounding hostilities and opposing obstacles, thrown in their way at every step by the jealous Hudson Bay monopoly, the footprints of American progress, which ever go in advance of and unaided by the federal government.

At the period of the gold discovery, about fifteen years since, this entire region contained not more than as many thousand white inhabitants, few of them having any settled purpose or permanent domicile, and most of them leading a life akin to that of the nomadic aborigines. It is true, there was a settlement of Mormons at Salt Lake, but this cannot be considered to have been anything more than a mere halting place, to rest and temporarily recruit the weary disciples of that faith while on their long pilgrimage from the navigable waters of the Missouri to the Pacific coast; and the final centralization of the "Latter-day Saints'" exodus in the great interior basin may be regarded as the result of one of those unforeseen occurrences by which the most sagacious human plans are foiled and entirely baffled by counteracting human agencies, in furtherance of the designs of the Ruler of the destinies of men.

Conclusive evidence is obtainable to show that the Mormon *hegira* set out from the Mississippi valley with the purpose of finding a lodgment on the Pacific coast in Alta California, a province then held in the feeble grasp of Mexico, and in the occupancy of a sparse and unsuspecting population, powerless to resist the invasion of the hordes of semi-religious zealots who had compacted their organization in bloody persecution, amid the smoking ruins of Nauvoo, and self-sanctified by martyrdom, were but repeating history when they found themselves so disturbed in the enjoyment of their peculiar doctrines in a hostile,

domineering community, that they were forced to turn their eyes toward the setting sun for a new Canaan.

Of all countries within their reach none promised the isolation required in so eminent a degree as California, as this portion of the globe was seldom visited by aggressive civilization. Indeed, fifteen years since California news found its way to the Atlantic coast by the "hide druggers," which doubled Cape Horn and twice crossed the equator in their tedious journey.

An advance colony of the Mormons had already penetrated the desert, and, scaling the Sierra Nevada, established themselves on the rich plains of San Bernardino, in the southern part of Alta-California; and the ship Brooklyn, following the devious route of the "hide druggers," had, about the same time, landed a numerous community of the Saints at Yerba Buena, now San Francisco. These two events occurred simultaneously with the gold discovery, the news of which, spreading abroad, set in motion toward the new Eldorado representatives of every nation and clime. Thus, while the Mormons were mainly seeking to reach the promised land by the slow, tedious overland route, swift-flying steamers ploughed the solitudes of the ocean, between Panama and San Francisco, bearing on their crowded decks multitudes of men of all trades and professions. With the landing at San Francisco of the first steamer's passengers, there landed also with them an organized American society, in full force and vigor, to work out its inflexible purpose of dominion.

The establishment of American society and customs in California was not the result of a *growth*—it was a *spontaneity*. On landing upon the shores of the newly-acquired territory, men fell into the employments which had previously become habitual, or that labor to which circumstances and their versatility gave them adaptation. Thus, agriculture, the mechanic arts, literature, politics, law, divinity—all the professions in vogue in older communities—were at once resumed.

With the gold discovery disappeared every hope the Mormons may have entertained of founding an empire on the Pacific coast, where isolation alone could shield them from responsibility to the outraged moral sentiment of modern civilization. And thus, perhaps, has been averted the spectacle of a power which, with its sanction of polygamy, sows around the domestic fireside impurity, the twin of slavery—both relics of barbarism—which, when hemmed in and forced to unwilling contact with a pure christianity, everywhere decay and die.

Although the volume of the Mormon emigration was brought to a halt at Salt Lake from causes briefly stated, their continued location at this point has hardly a less remarkable influence on the progress and development of the States and Territories west of the Rocky mountains than it would have had had it reached its point of intended destination. Being half way on the overland route, Salt Lake City, with its abundant supplies for man and beast—the product of the most extraordinary agricultural perseverance and tireless industry anywhere ever seen—offers facilities for the transmigration of large numbers of people and stock, as well as to furnish food, indispensable to those engaged in prospecting and working the mines in vast sections of the great interior basin.

Passing over the fifteen years which have elapsed since the gold discovery, when the white population in the three States and four Territories named did not exceed fifteen thousand, we may safely estimate that it has swelled at this date to near one million of souls. That so numerous a people, occupying so varied a soil and climate, covering so wide a region over which they are dispersed, remote from the commercial facilities of older communities, should find it incumbent, as their wants increase with the growth of the population, and the accumulation of wealth permits the indulgence in more luxurious habits, to examine their undeveloped resources for the means of supply, is the teaching of a correct public economy.

Hence the question of soil, adaptation of climate, and the available supplies of labor with which to grow the raw material of both the articles of first neces-

sity and of luxury, must be considered before conclusions can be drawn as to the capacity of a country to support a large and permanent population in a condition of continuous prosperity, exempt from too exacting a tribute to foreign trade.

Next in importance to the cost of its food is the annual expenditure of a people for clothing and the other various uses to which the textile fibres are put after being made into cloths for bagging, tents, ship-sails, carpets, and general household furniture and upholstery; and were an inventory at any time to be taken of the two values, it would doubtless be shown that the sum total invested in textiles would greatly exceed the cost of the esculents. From this it may be seen how much the wealth of a nation is affected by the production within its territory of its requirements of woven fibres. A nation, however, may be only a purchaser of raw materials, and by becoming its manufacturer still derive a considerable share of prosperity from the enterprise. This is seen in the history of the cotton, silk, and woollen manufacture in Great Britain, where neither cotton nor silk is grown, and wool but in limited quantities. Were Great Britain the grower of the raw material she spins and weaves, how vastly greater would be the accumulated profits to her people. The United States are very large producers of both cotton and wool, and the writer, in the course of this article, will endeavor to show that within her limits there is a vast region which has both the atmospheric and meteorological conditions requisite to constitute her the greatest silk-producing country on the globe.

The production of textile fibres has been deemed of such vital importance to the people of California that the legislature passed an act offering very large bounties to those producing the first of a given quantity of the several textiles to be exhibited before a board of judges, of which the governor of the State is president. The sum total of bounties, offered by the legislature reaches the sum of $111,200, irrespective of the annual appropriation of $4,000 to the State Agricultural Society, besides $1,000 each to the four district societies, and $500 each to the county agricultural societies, to be expended in premiums for articles the product of the industry of the people of the State, The act of the legislature contemplated the production in the State of nearly all the great staples of every-day necessity, as well as many of the luxuries, which put every clime under tribute to furnish supplies.

The reasons why cotton culture in the Pacific States will never be a successful industry, except in a few localities in the southern part of California, will effectually explode all visions that this side of the continent will never become a formidable rival of the Gulf States as a grower of cotton textiles.

COTTON-GROWING IN THE PACIFIC STATES A FAILURE FROM METEOROLOGICAL CAUSES.

No plant in the vegetable kingdom, holding so important a relation to the necessities of mankind, requires so pampered an existence, both in the nourishment it must obtain from the soil and the required condition of the atmosphere, in order that it may reach its most perfect development and maturity, as does the cotton.

Sensitive to cold in the extreme degree, if the spring is excessively wet the young plants will have a yellow, sickly hue, and maintain a precarious tenure of life, until the summer solstice has deeply and effectually warmed the earth about its roots. The States and Territories on the Pacific slope, to which I design my observations to apply while treating of cotton culture in this paper, have the meteorological phenomenon of a wet and dry season, each occupying with rigid exactness an equal portion of the year. The wet season commences in November and terminates in May. During this period there is a low temperature of the atmosphere, so that, with the frequent and often copious showers of

rain, the earth becomes cool and stores up a supply of moisture against the impending six months of drought. This coolness of the atmosphere and soil, while favorable to the cereals and grasses, is, in the reverse ratio, detrimental to the cotton plant. Of a large number of plants growing in different portions of the State, which I have examined, not one of them had a healthy appearance until after the close of the rainy season. The close of the rainy season is succeeded by cold, dry winds which have the effect to dry the surface of the ground; this checks the growth of the surface roots and induces the sending down of a single strong tap root in all of the annuals. Plants which procure their sustenance chiefly from a tap root, spindle up with a corresponding stem, quite as devoid of vigorous side branches above the surface of the ground as they are of lateral roots below it. This is the condition in which the cotton plant is found in the beginning of the season in California. The object of the cultivator should be to induce the emission of vigorous side branches at as early a period in the season as possible, as it is on these he must expect to find the earliest maturing bolls. The emission of strong lateral branches on the cotton plant is greatly promoted by frequent warm rains during June and the early part of July, a climatic phenomenon unknown in the Pacific States. The cotton plant is mainly a surface feeder, which seeks its nutriment from the debris of decaying vegetation of the previous year, as it undergoes rapid decomposition under the heat of a tropical sun and a constant immersion of rain and dew, and in all stages of its growth makes enormous demands upon the soil and atmosphere for supplies of food.

The plant, starting on its career in California under unfavorable conditions, continues to meet, at every stage of its existence, a meteorological phenomenon no less disadvantageous. The climatic condition so inimical to the health of the plant consists in the certain recurrence of a low temperature throughout the night, succeeding the high temperature generally prevailing throughout the day. In nearly all of the interior districts, protected by ranges of hills from the cold winds and fogs of the ocean, the average temperature at noon may be set down at 80° Fahrenheit, while in the same localities at midnight it will have fallen to 60°. This extraordinary variation continues throughout the summer season, and is accompanied with dry parching winds which rapidly extract the moisture from the surface of the soil as well as from the foliage of the plants, shrivelling the leaves so that their valves become choked by minute particles of dust, thus checking respiration, or stopping it altogether. The leaf of the cotton plant is endowed with uncommon absorbent functions, and in countries where there are copious warm night dews it will thrive vigorously without rain. Dews, however, seldom fall in California after the close of the rainy season, beyond the region penetrated by the ocean fogs. From this it may be seen that the Pacific States have neither the periodical rains nor dews requisite for the nourishment of the cotton plant. It may be contended that the absence of rain may be remedied by artificial irrigation. This may be true of California, where the means of irrigation on a large scale are obtainable at moderate cost. But passing this objectionable mode of supplying a deficit in nature, there can be no artificial way devised by which to compensate for the absence of nightly dews. Even could this difficulty be obviated so as to get the plant started in a condition of promise, there is still, later in the season, an opposing meteorological condition to be met which no expediency of art can overcome or modify, so there will, at last, be an insuperable obstacle to successful cotton-growing in the Pacific States. This phenomenon consists in the arid atmosphere which prevails during the period while the bolls are expanding and bursting open.

The cotton fibre is formed by the hardening of the milky secretion hermetically sealed in the green boll, the rind of which is of a tough elastic consistency when approaching maturity, and is divided from the stem to the apex by a number of sutures, held together by a natural glue. When the fibre begins to mature the bolls change from a green to a dull grayish brown color, and it is at

this period that a favorable climatic influence is required more than at any other time of its growth. If the weather is dry, with an entire absence of nightly dews, the bolls open with difficulty, and the staple will be found harsh and uneven. A warm, moist, soft atmosphere keeps the rind of the boll pliable, so that its fullest expansion takes place, while the fibre is acquiring its finish, thereby enabling it to form regular layers, and giving it a silky consistency. Where this soft, moist condition of the atmosphere prevails, the rind of the boll will commence opening at the apex, the glue being dissolved by the night moisture, so that several divisions of the shell will roll outwardly and below the point of intersection at the base, thus leaving the cotton free to be plucked without the fingers of the picker being forced against the rind. Where the atmosphere is dry, as it is in all of the Pacific States and Territories with the exception of those portions exposed to sea fogs, the bolls of the cotton plant will be irregular in shape, and the fibre consequently uneven in texture. Nor can the bolls readily open, because the glue which holds the joints of the rind together becomes only partially dissolved; hence it may be observed, on examination, that the sharp points of the rind project amid the expanding fibre, so that it will be difficult to pick it out, because of its entanglement in the pieces of the rind, as well as from the pain inflicted upon the fingers of those engaged in gathering it.

Cotton may be grown with a fair amount of success in the southern part of California, where the climate is warmer and of a more even temperature than in the middle and northern portions; but even there it cannot be made to compete with the Atlantic and Gulf cotton-growing States, either in the quality of the staple produced, or in the price at which it may be profitably grown.

Even in the Atlantic and Gulf States there are climatic reasons why certain localities produce a better grade of cotton than others. The character of the soil on which the plants are grown has less to do with the character of the product than atmospheric influences. Take the sea island for illustration. It nowhere compares in fertility with the delta of the Mississippi. Yet the sea islands produce the most valuable cotton grown on the globe, while in the delta of the Mississippi the staple is scarcely up to a fair average of American cottons. The sea islands possess more fully every requisite of climate for the perfection of cotton-growing than any other locality in America. They have an evenness of temperature, with warmth and moisture, nowhere else found in the same degree. Efforts have been made to grow the sea island staple in various portions of the globe, without success, except it may be in a limited locality near the mouth of the Nile. Nor can this unequalled, long, silky textile be produced anywhere else than on the American sea islands, until natural laws can be changed.

As a further illustration of the atmospheric influences which affect the cotton plant, it may be remarked that the most precarious cotton region in the cotton States is that lying along the banks of the Mississippi river. The waters of this great affluent remain cold from taking their rise in snowy latitudes until they reach the Gulf of Mexico, continuing in this condition until well into summer. Hence there is a low temperature given the atmosphere near its banks during the night. This often keeps the cotton plant in a backward state in the spring, predisposing it to the attacks of the army worm and other enemies.

Regarding the present high price of cotton fibre as temporary, rather than to be permanent, the cultivation of this textile does not promise to be either extensive or remunerative in the Pacific States and Territories, and however desirable it may be to have sufficient produced in those localities for the consumption of the resident population, climatic reasons will be found an insuperable obstacle to even a partial success in this industry.

FLAX AND HEMP IN THE PACIFIC STATES.

If the meteorological condition in this region is unfavorable for the cultivation of cotton, it might be supposed that there should exist a congeniality for flax and hemp, because either of these textiles will thrive under climatic influences unfriendly to cotton. Both flax and hemp, however, demand one of the prerequisites of climate which must be had by the cotton plant—moisture. But cotton requires a high temperature with moisture, while flax and hemp succeed where the mercury falls so low that the cotton plant will have a yellow, sickly hue.

Flax in Ireland and Germany, and hemp in Kentucky, Missouri, and the empire of Russia, succeed best on moist, alluvial soils, near large bodies of water, where there is a moderately low temperature during the night. Alluvial soils and the requisite low temperature are obtainable in large districts on the Pacific coast, and both flax and hemp make a large growth of straw wherever cultivated upon them. From this it might be inferred that both of these textiles could be grown in the Pacific States to supply the local demand, and even for export.

The production of the straw of flax and hemp is only a small part of the cost of the textile, and is the least difficult labor in the whole enterprise. The most critical operation is the rotting process. This not only requires skill and judgment, but for its thorough and perfect accomplishment we must have the aid of regular copious dews, or the facilities to rot it in artificial tanks. The process of hackling so as to separate the fibre from the haulm or woody parts, though tedious, is not affected by climatic influences. In the Pacific States there are no dews of certain regularity, such as would accomplish the rotting of the woody parts of flax and hemp sufficiently to enable the separation of the fibre; nor are the facilities for water-rotting to be had except in limited supply, contiguous to the localities where the textiles would be grown. Indeed, the only favorable situations for growing the straw, having facilities for water-rotting at hand, are the table lands on the San Joaquin and Sacramento rivers; but these, owing to frequent inundations, would render the investment of capital in their cultivation precarious, until some general and costly system of reclamation shall have been adopted.

The absence of dews and the inconvenience of providing the means to water-rot the straw, are only incidental obstacles in the way of success in flax and hemp husbandry in the Pacific States. The real, insuperable difficulty in the way to success will be found in the fact that neither flax nor hemp has a textile fibre of any value when grown in the dry, brazen climate of the Pacific slope. Noticing the brittleness of some green hemp which I found growing wild along the mining canals in Eldorado county, I was led into an inquiry as to the character of the fibre on flax, hemp, and a large variety of plants indigenous to the country, whose related species have a fibrous tendency in climates where there are periodical rains, and, to my surprise, I found the same indisposition to clothe itself with a fibrous cuticle prevailing among all of the vegetable tribes.

It is remarkable how quick the annuals disappear in California after the first heavy rains in the fall. A swamp of mustard which, before the rain, will be found impassable even to the wild Spanish horses and cattle, no sooner becomes soaked by the first showers in the fall than the tree-like stems snap to the merest gust of wind, and, what was shortly before an impassable barrier to man and beast, will lie prostrate, rapidly decaying into debris to nourish the young vegetation which immediately shoots up to take its place. This is but the condition of all the annuals, and especially so with the grasses and the straw of the cereals. All vegetable substances in this climate have a proneness to become brittle towards maturity, and even the basket willow loses its pliability, and all other varieties of woods, whether indigenous or transplanted from other

climates, fail, when grown here, to have that elasticity and toughness which give value for mechanical purposes.

This lack of fibrous cuticle on the annuals and the brittleness of the stalk must be attributed to the dryness of the climate during the growing season, as but little rain falls after vegetation starts, and none while it is in process of maturing. Hence, in place of a fibrous bark, which vegetation acquires in countries exposed to periodical rains, the cuticle of the same plants in a dry climate is a glutinous substance. Thus, all species of vegetation are enabled to resist the strong winds which prevail in all arid climates until this gluten is dissolved by the rains of the wet season, when, as before remarked, it rapidly decays and becomes a vegetable mould to enrich the succeeding generations of vegetable life.

The early Spanish colonists discovered among the natives of the country only a single species of vegetable fibre of which they made any use, and this was an indigenous hemp, of which they manufactured no other article than their rude fishing nets, and this, too, was grown about the Tulare lakes, probably the most humid locality in the country. If the climate had been favorable to the growing of vegetable fibres, should we not expect to find among the aborigines textile fabrics manufactured from the same into articles of utility and necessity? One of the most attractive features of semi-savage or barbarian life in Central America, or among the myriads of the Oriental tribes, is the domestic thrift occasioned by the ingenuity of the people in working vegetable textiles into clothing and all manner of useful implements. Where this is to be seen, however, there is an accompanying moist climate. To this phenomenon may we not ascribe their success in growing vegetable textiles? If we look at the character of the climate required for the most successful production of our own great textile fibre—cotton—we find it comprised within the limits of the Gulf of Mexico and Cape Hatteras, a region having a more regular and copious isotherm than any other of equal extent.

Comparing, then, the climate of the Pacific States with the climates of the countries where cotton, flax, and hemp are produced in greatest perfection and abundance, little encouragement offers for the production of these great staples of commerce in the Pacific States as a successful competition, and it is questionable whether the attempt to grow sufficient for the wants of the resident population will be a correct public economy while natural laws are so insuperable an obstacle to success.

ANIMAL TEXTILE FIBRES IN THE PACIFIC STATES AND TERRITORIES.

However much the climate of the Pacific may be lacking in the elements which conduce to the successful culture of cotton, flax, and hemp, this vast region is fortunately blessed with other resources which amply compensate the foregoing deficiencies.

Its capacity for the grazing of sheep and other fleece-producing animals can hardly be estimated. Not only is the herbage abundant, and of a quality suited to the nature and habits of sheep and goats, but the climate is so mild and equable, and the atmosphere so pure, that animals attain here their most perfect development in form and size, while they also retain a remarkable degree of health, notwithstanding, from their gregarious habits and the conformation of the country, they are often herded in vast flocks.

The perfect adaptation of the country to wool-growing was long since exemplified by the enterprise of the mission fathers, who could procure no other textile with which to clothe the hordes of rude savages which they collected at the various mission establishments. Indeed, the fact that the fathers no more cultivated cotton, flax, and hemp than had the natives of the country, is cumulative evidence that textiles of vegetable growth could not be successfully pro-

duced. Hence, with that singular intelligence which rendered every enterprise the mission fathers undertook a practical success, they at once commenced sheep husbandry on such a scale of magnitude that, in no long time, the rude inhabitants who flocked to the missions were clothed in garbs more fitting their advent among those of Christian civilization.

The extent of sheep husbandry, conducted by the Catholic priests at the missions, may be realized when it is stated that at seventeen of the establishments, located on a line near the sea-coast, and extending from San Diego to San Francisco, a distance of about five hundred miles, there were, in 1825, the period when the missions were at their greatest height of prosperity, an aggregate of one million three thousand nine hundred and seventy sheep. This does not include the flocks of sheep owned by the rancheros which were, doubtless, quite as numerous as those possessed by the church. Besides sheep, there were grazed at the missions enumerated eighty-eight thousand four hundred and eighty-four horses and mules, and one million one hundred and eighty-eight thousand three hundred and ninety-six head of cattle, while, within the same narrow strip along the coast, private rancheros herded far more numerous droves.

This wonderful exhibit of pastoral industry was all contained in a limited district of California, because at that time the great San Joaquin and Sacramento valleys, the country north of San Francisco bay and the foot-hill regions of the Sierra Nevada, were in the occupancy of the hostile tribes of savages. This thrift, too, marks the last decade of Spanish vice-regal dominion in California, and its subsequent rapid decline may be traced from the commencement of Mexican misrule, when the rich accumulations of the mission fathers fell an easy prey to irresponsible military and civil official rapacity.

When the United States took possession of the country, it was seen that a quarter of a century of Mexican misgovernment had been sufficient to accomplish the ruin of the missions, by the annihilation of nearly every vestige of the remarkable industry planned and put in successful execution by the sagacity, courage, and perseverance of the priests, and in no other feature was the destruction so total and disastrous in its consequence to the helpless Indians as was the sudden extinction of their sheep husbandry. By this, the hordes of savages who had been gathered around the missions, looking solely to the fathers for food and clothing, were deprived of their only source of supply, and having acquired scarcely any other feature of civilization than dependence and some of its worst vices, were, when thrown back to savage life, swift victims of hunger and nakedness, disappearing from view as if swept from the earth by an all-devouring pestilence.

The sudden rise and temporary prosperity of sheep husbandry under the care of the mission fathers was owing to a local exigency in which commercial considerations had no influence. The isolation of the country from the outside world was a bar to all thought of foreign traffic. The mission fathers reared their flocks of dumb brutes, scarcely more dumb than the people they were trying to christianize, solely for the purpose of obtaining a textile from which to fabricate garments for the savages, as an auxiliary means of proselyting. And it is this very isolation from the commercial world which caused so sudden a disappearance of a great agricultural industry. Brief, however, as was its existence, it rose to such a magnitude as served a great purpose. It left a history full of significance to an energetic race, following shortly afterwards and bringing in their advent commercial necessities as fixed as natural laws. This new race is re-establishing sheep husbandry in California on a basis so firm and enduring that no adventitious circumstances can accomplish its ruin.

The following extract from an article written by James E. Perkins, secretary of the California Wool-Growers' Association, will be found interesting as a comprehensive review of sheep husbandry in the State, from its settlement by Americans down to the year 1863:

"For several years after the settlement of this State the opinion prevailed, very generally, that sheep could not be raised here to any profit for their wool. It was argued that the extreme heat of the summer and the dry food on which they must subsist for a large part of the year would tend to produce a fleece so light and thin as scarcely to pay for shearing. Under this impression, those who owned or purchased sheep looked only to the market for mutton for their outlet and profit.

"Scarcely anything but the native or New Mexican sheep could be found, and these, worthless as they were, were still further debased by crossing with some Chinese rams which were imported about the year eighteen hundred and fifty-two or three. The only recommendation either of these classes of sheep possessed was their prodigious fecundity, the ewes often bearing triplets, almost invariably twins, and sometimes five and even seven lambs at a birth. In size, form, constitutional vigor, and disposition, they were the perfection of all that is undesirable, while their fleece rarely exceeded two or two and a half pounds of coarse, uneven, kempty wool, suited only to the very lowest class of fabrics, scarcely worth the cost of sacking and transporting to market. Yet it is from this basis that our stocks of the present day have mainly sprung, and we owe to it the demonstration of the suitability of our climate and grasses for the raising and keeping of the superior classes to which we are now approaching.

"During the years eighteen hundred and fifty-two, three, and four, quite a number of Missouri and a few Ohio sheep were driven across the plains, and towards the latter of those years some fine importations of Australian sheep were received, all of which found a ready sale at remunerative prices. Most sheep-raisers, who have been long in the business, can well remember when the possession of a very ordinary American ram was considered a most fortunate thing, and half-breeds (*i. e.*, crosses of American rams on Mexican ewes) were eagerly sought for.

"The immense increase of sheep raised in the State, and the continued introduction of immense droves from New Mexico, very shortly brought the stock of mutton sheep fully up to the demand from the butchers, and threatened, at no distant time, to be so largely in excess as to reduce prices far below the cost of production. As early as the year 1854 some of our most enterprising sheep-raisers anticipated this result, and believing that a climate and range on which the poorer breeds seemed to thrive so well must answer equally as well for the higher classes of sheep, and that they could be raised here for the fleece alone, set about the importation of thoroughbred merino rams of Vermont and New York. To Messrs. Curtis and McConnell, of Sacramento county, belongs the credit of the first importation of the Vermont or, generally designated, Spanish merino. Both these gentlemen are now dead, but they lived to see and reap the fruits of their foresight. Other importations of both French and Spanish merino stocks rapidly followed, as also of Cotswold, Leicester, and Southdown. Large numbers of Australian rams and ewes were brought in and all sold at extreme prices. Before the year 1860 there was scarcely a flock in the State that had not some infusion of improved blood from these importations, and the character of California wools began to exhibit a percentage of improvement scarcely less than the increase in quantity, until, at the present day, an unmixed flock of native sheep is by far more rarely met than were improved flocks in 1856.

"A glance at our estimated wool clips for the past ten years will show the rapid increase and the important position already attained, viz:

Estimated product of wool in pounds.

1854	175,000	1859	2,378,250
1855	360,000	1860	3,260,000
1856	600,000	1861	4,600,000
1857	1,100,000	1862	5,530,000
1858	1,428,350	1863	6,857,109

"In eighteen hundred and fifty the census reported our wool product at about five thousand pounds; but it was not until eighteen hundred and fifty-four that it attained sufficient magnitude to obtain notice in the list of exports. That year we shipped one thousand one hundred and twenty seven bales. The following table shows the extent, in bales, of our exports for each year since, viz:

Export of wool in bales.

1855	2,487	1860	12,082
1856	3,924	1861	15,984
1857	6,664	1862	22,113
1858	6,496	1863	18,146
1859	10,570		

"A considerable portion of the wools shipped this year has been in pressed bales, weighing from five hundred to eight hundred pounds each, the ordinary bales heretofore averaging from two hundred and fifty to three hundred pounds each.

"Of the entire export up to the year 1856, probably nine-tenths was of the native breed, originally poor enough, and sent forward in such abominable condition as still further to depress it in the estimation of dealers and manufacturers; and prejudices were then formed against California wools from which they have not yet recovered. The rapid increase of our exports of wool is beginning to attract the notice of eastern manufacturers, and already California is looked to for a respectable portion of the yearly supply."

PRESENT CONDITION OF WOOL-GROWING.

Sheep husbandry in California, under the stimulus of a commercial demand for wool, has been attended with more than the success and failure which usually accompanies the impetus given all new enterprises by prospects of large gains, so attractive to every class of Americans. In this State, however, the business of sheep husbandry has been mainly conducted by two classes of persons—the capitalist, who invested his money in large flocks, and residing in the city or town, gave no personal care to them, but intrusted them to hired shepherds whose qualifications were not of a high order; and those who commenced with limited means and remained with their flocks, devoting all their abilities and increasing profits to the business as a specialty. Few persons engaged in cereal farming have as yet entered into sheep-rearing as a part of their operations.

Short as the time has been since sheep husbandry, under the system of improved grades of wool, was commenced, it has been quite long enough to discourage the capitalist who devoted nothing to the enterprise but his money, and it is probable that, at this time, nearly every one of these has sold off his flocks and abandoned the speculation in disgust. This, however. should not be considered an unfavorable indication with reference to the climate and pasturage of the country for wool-growing—it should be considered as in no wise discouraging. Those persons who invested capital in large flocks of sheep and intrusted their management to ignorant, uninterested employés, argued that because the mission priests conducted sheep husbandry on a large scale, with stupid Indians as shepherds, there ought to be no failure where, at a later day, a more intelligent race of people could be employed for this purpose, overlooking the fact that the mission fathers lived in the midst of their flocks, giving them their constant, watchful, intelligent oversight.

The persons who alone have met with a large degree of success in sheep husbandry in California are those commencing with a limited number of sheep, or, by uniting personal superintendence with the investment of capital, have followed the example of the padres, and remained with their flocks. The

largest proprietors of pure merinoes in the State can look back only a few brief years, when, with weary steps, they followed their dozen or two of pure-bloods from the rising to the setting sun, camping in their midst at night in the solitude of wide stretching prairie; and now they may sum up the results of their patient, persevering effort in flocks which will number tens of thousands. It is doubtful, however, if the accretion of forty or fifty thousand sheep in the hands of a single proprietor is correct public agricultural economy, or will, in its entire results, be profitable to the owner. Under favorable circumstances the year's gains may be satisfactory; but, should a season of drought, such as occurred in 1864, take place, the difficulty of subsisting so many animals in a restricted district must be attended with great losses from starvation, while even in the most favorable seasons epidemics are liable to break out in large herds, and from an inability to treat individual animals for the infection before it becomes wide-spread, the entire flock may be decimated. It would be a better policy for the farmers of the State to adopt a more diversified farming, for among a greater division of interests wool-growing could be made exceedingly profitable.

ALL FARMERS SHOULD BE SHEEP-GROWERS.

There are many reasons why every farmer would find it profitable to keep a small flock of fine-wool sheep on a farm where grain is the principal crop. By raising his own mutton a large saving is made in the butcher's bill; the sale of the wool will bring ready money just before harvest, when it is most needed to conduct the farming operations with celerity and economy. Nor are these the greatest benefits to accrue from a system of mixed farming in which sheep-raising has its appropriate share. Sheep are the best scavengers which can be put on a field after the grain is cut, to clear the land of weeds, while their droppings are a far better fertilizer than the debris of stubble and litter they consume, which otherwise would have to be ploughed under to decompose. In a country like California, where the noxious herbage tends to a rapid usurpation of the soil, the services of sheep are invaluable to keep the land from being overrun by poisonous weeds.

When sheep-husbandry shall become, in the Pacific States, a part of every farmer's operations, we may look for a much higher standard in the grade of wools there produced, as it will be in the power of the small herdsman to cull out the worthless or inferior animals, and to retain, for breeding purposes and the fleece, only such as are of superior quality. It must not be inferred, however, that the large herdsmen are indifferent in the matter of breeding; they are constantly improving their flocks. In no wool-growing country is there, probably, more expense and painstaking incurred in the attempt to obtain animals of the best points for breeders, both male and female, than in California; but this must necessarily be limited to such animals as are kept for special breeding, as, where flocks number tens of thousands, the matter of pairing the male and female so as to secure an improved offspring is, in a great measure, impossible.

SHEEP STARVATION IN THE PACIFIC STATES.

With a cool, healthful climate throughout the districts lying between the Sacramento and San Joaquin valleys and the shore of the Pacific ocean, there is no season of the year throughout this vast sheep-walk when animals are liable to receive injury either from an excess of heat or cold, nor are winter rains so severe as to cause the death of the most delicate where ample supplies of forage are stored so as to give a small feed of hay during the short season between the destruction of the old grass by the rains, and the appearance of the new. Favorable as his appears to be for the prosecution of sheep husbandry, yet the losses throughout this region during the year 1864 were, in the aggregate, one-

third of all the sheep within the district, and caused solely by starvation. It should be remembered, however, as a mitigating circumstance, that this year was one of extraordinary drought, and it brought to light, in a very forcible manner, the improvidence of the stock-growers of the Pacific States, as nearly every one was caught without a pound of hay stored up against such a contingency. Even in years of plenty the losses by death and shrinkage, from a short supply and the bad quality of the food which sheep are able to pick up out on the range during the inclement season between old and new grass, are always very large. This could be avoided by a little attention to the cutting and stacking of hay in the spring, when the grass is abundant. This most inclement season of all the year is the period when the female is in gestation, and if subjected to a low and scant diet, will be in bad condition for parturition, and afterwards to suckle her young.

The annual shearing takes place in the spring, at a time when the animal is in good condition, with an abundance of food to keep it so for some months afterwards; hence the fibre of the new-growing fleece comes out of the cuticle strong and of even texture. But if starvation overtakes the hapless animal, the skin shrivels as the sheep declines in flesh, and this materially affects that part of the staple then pushing through the cuticle, rendering it weak and uneven. Subsequently, as the animal again has access to an abundance of nourishing food, and recovers in flesh, the fibre resumes its first strong, even condition, but there will be a weak spot in the middle, caused by the famishment of the sheep. Such wools are greatly deteriorated in value on account of the weak spot in the fibre; because, however fine the staple, if it is not even it is unfit to be spun and worked into the finest cloths.

ANNUAL MIGRATION OF SHEEP BENEFICIAL.

Among the lessons taught the wool-growers of California by the excessive drought of 1864 was that of the benefit of migration. The absolute impossibility of keeping alive their vast herds in the valleys and coast districts, led many sheep-owners to adopt a plan similar in some respects to the Spanish custom called the *mesta.* The great merino flocks of Spain are wintered on the plains of Estramadura and the lowland provinces, where the climate is so mild that the grazing is good through that season, but on the approach of hot weather, about the first of May, they are made to take up their annual line of march for the elevated mountain ranges. The journeys are made in vast flocks, comprising often fifty thousand in a *mesta,* subdivided into divisions of ten thousand each, and the space travelled over frequently reaches a distance of three or four hundred miles. By this means the sheep are always retained in a temperate climate, avoiding the extremes of the summer heat on the lowlands and the severity of the winter on the mountains.

The value of the Sierra Nevada range has been little understood by stock-growers until the past season of drought in the valleys and coast districts. Many stock-growers fled from the famine on the plains to the mountains with their flocks and herds as from a pestilence, and this migration which began in necessity was so advantageous in its results that it is likely to become an annual custom. The cattle and sheep driven to the elevated pastures on the Sierra not only found an abundance of nutritious grasses, but the fine climate was so favorable to animal life that they were returned to the valleys when the snow compelled their removal in the best of condition.

A particular flock of merinoes, numbering five thousand, which were being tended on a share of the increase by two intelligent young men, were driven from the coast range to the Sierra Nevada and pastured through the summer, and again taken to the coast at the approach of winter. This lot of sheep were culls out of a flock of forty thousand, and not a good average lot, many of

them being sickly. Going away inferior, they came back superior to any five thousand which could be selected from those which had been summered in the valley. Their improvement over the flock remaining through the summer on the plains was doubtless owing more to a change of diet than climate, as none can be more equable and favorable to the health of sheep than the coast districts.

Added to the nutritious grasses was the great variety of the coniferous tribes, with their resinous properties, to which the sheep had, at all times, unrestrained access, the medicinal benefits of which were abundantly apparent.

There are vast ranges in the Coast mountains, on both sides of the Sierra, where herds have not yet been grazed, to which stock-growers would do well to drive their herds in the summer, and thus enable them to save the forage of the valley for winter use, adopting thus, to some extent, the custom so long in vogue in Spain, which alone enables her sheep-growers to profitably conduct this great branch of agricultural industry.

THE GREAT CENTRAL BASIN FOR SHEEP-GRAZING.

Eastward of the Sierra Nevada, and extending twelve hundred miles to the Rocky mountains, are wide stretching-deserts, narrow, fertile, circuitous valleys, enclosed by hills and mountains, covered with rich grasses and other herbage, dividing the whole Territory into a multitude of natural divisions. With an average breadth of more than a thousand miles, this great sheep-walk extends from our southern border on Mexico to British Columbia on the north. A great deal of the soil consists of alkaline flats and desolate sand-drifts covered with sage brush, but there are, bordering on these, natural meadows of coarse, wholesome grasses, while the hills and mountains, ever present to the view, are covered nearly to their rocky summits with the finest pasturage. In the future this will be especially designated as the great pastoral region of the American nation, not because there may be a demand in distant markets for the wools which it may produce, but for the reason that the mines of the precious metals sown thickly in every hill and mountain will attract to this part of the continent a dense population for their development, which must find its chief supplies of food and clothing from the produce of the herds grazed in their midst. Thus, in a great measure, will be settled the difficult problem of transportation for these nearly inaccessible regions. The result of the industry of the population in the great interior basin, being reduced to bullion, will place the manual labor employed in all co-operative branches on an equable basis; hence, as the transportation to the commercial centres of the bullion, by ordinary modes of conveyance, will not be onerous, people who make the production of the precious metals the basis of their collective industry will be more favorably situated than those engaged in that species of agriculture which must seek a distant market over a costly transportation. The production of wool, and its manufacture into articles suited to the wants of a frontier population, is rapidly assuming importance among the industrial employments in the Pacific States, and the time is not far distant when the export of woollen fabrics will be a large item in their favor.

SILK CULTURE IN THE PACIFIC STATES.

Before the writer commenced the preparation of this paper he obtained a promise for the history of his experiments from a gentleman, a native of France, who had been engaged in silk culture in that country, and has, during the past five years, devoted a large share of his attention to the same occupation in California. Indeed, he wrote, in reply to my request for full particulars of his operations in silk culture during these five years of his experiment, that he had prepared a long letter upon the subject for my use, which embodied a

brief but full history of his experience with silk culture in this State, but upon reflection he had concluded not to publish anything on the subject for at least five years—not, as he stated, because he was dubious on the subject, or had thus far met with such doubtful success as to discourage, in the least, its further prosecution; on the contrary, his most sanguine expectations had been more than realized. I quote a sentence from this letter, in which he says: "I have made the culture of silk in California a grand success, but, except yourself and a few others, nobody believes it. I shall now, for a few years, keep my information to myself and get the benefit, and prove, at last, that as we have cotton-growing States, we also shall have silk-growing States."

It may be well to state that this gentleman is as yet the only silk-grower in California, and as he is receiving orders from France for all the eggs of the moths he can raise, his threatened silence upon the subject for the next five years is probably accounted for. It was my expectation that his promised article would have comprised all I intended to publish in this paper. His reticence, however, necessarily compels me to the alternative of passing in silence one of the most interesting of the textile fibres, or of trusting to memory for whatever facts connected with silk culture which came under my observation when, at various times, I have been, through the courtesy of this gentleman, permitted to inspect his cocoonery, and heard from his lips many particulars concerning his management of the silk-worm. Regretting that the valuable information in his power to contribute to the public good concerning one of the great industries should be withheld from publication, the writer trusts that when this impatient son of Gaul shall have become mollified by a more credulous public, and many shall become as enthusiastic on the subject of silk culture as he is, it may be his pleasure to communicate to the Department of Agriculture the desired information. The writer trusts that, however great his poverty in personal experience as a silk-grower, he may be able to state some facts in regard to the adaptation of this industry to the Pacific coast which may serve to direct attention to this subject.

INTRODUCTION OF THE SILK-WORM OF RECENT DATE IN CALIFORNIA.

In searching the old mission orchards we nowhere find the mulberry tree among the rich collection of the fruit-bearing species. This absence may be taken as conclusive evidence that silk culture formed no part of the varied industry introduced and conducted by the padres. I have already shown that they produced the textile fibre of wool in such abundant supply as to enable them to clothe the hordes of naked savages who were gathered about the mission establishments. Thus it would seem that articles of utility rather than of luxury received encouragement at their hands. Nor can there be found in the written history of the missions anything showing that the priests were any more aware of the unequalled adaptation of the country, by reason of climate, to produce silk, than there is to found a surmise that they knew of the wonderful deposit of the precious metals in the soil on which they stood, which, like silk culture, awaited disclosure and development by another race. Silk culture, however, has not as yet arrested the searching, restless eye of American enterprise; and after fifteen years of occupation, when nearly every source of wealth has been explored in the rush for gain, there appears only one solitary individual in the State engaged in silk culture, and this one endeavoring to "hide his light under a bushel."

If we look at the progress of silk culture in other countries, it ceases to be a matter of surprise that so little attention has been given the subject in a young community, isolated from manufacturing centres. The production of silk in such quantities as to place it within the reach of every member of the community was not accomplished until the introduction of labor-saving machinery had so

far relieved manual labor of the drudgery incident to ill-paid toil that the emancipated laborer not only craved the indulgence of his more refined and elevated tastes, but found himself in a condition to obtain possession of luxuries before within the reach of the wealthy only.

The silk-worm—*Bombyx mōri*—was introduced into Europe from China in the year 160 A. D., and it was not until after the lapse of fourteen centuries that its cultivation became firmly established as one of the great industries of the nations bordering on the Mediterranean sea. In 1825 an attempt, commensurate with the usual large expenditure attending English enterprises, was made to introduce silk-growing into Great Britain. A company, called the "British Irish and Colonial Silk Company," was formed, with many leading statesmen among its members. This company established extensive plantations of mulberry trees in England and Ireland, but, after thirteen years of costly trial, dissolved their association and abandoned the enterprise as a failure.

During the latter period of the existence of the English company the *Morus multicaulis* excitement seized upon large numbers of persons in the United States, involving great outlays of money in the propagation of the trees to feed the silk-worm, but speedily ending in a failure which involved thousands of persons in hopeless bankruptcy. With these two stupendous failures in silk culture, occurring simultaneously in Great Britain and the United States, it should not be expected that the immediate descendants of a generation so disgusted with an industry which promised largely in theory, but was so barren in practical results, could easily be led into an enterprise about which the agricultural literature of both countries spoke disparagingly, and while there was still living a cloud of witnesses to cast upon it opprobrium.

SUCCESS IN SILK CULTURE A QUESTION OF CLIMATE.

If a proposition were made for the formation of a company to grow the sugar-cane *(officinarum)* in England or the northern United States, the dullest person applied to, before taking stock, would be apt to inquire if the climates proposed were suitable for success, which at once involves meteorological considerations.

Had this English company instituted thorough investigations into the habits and requirements of the silk-worm before making their large outlays of capital, they doubtless would have discovered that a climate subject to excessive moisture from fogs, frequent showers, and often long protracted storms, had natural obstacles to silk culture which could be overcome by no appliance of art. Add to this discouraging feature an accompanying phenomenon of nature, the presence of explosive electricity, and the question of the successful culture of the silk-worm in Great Britain or the Atlantic States would be settled in the negative.

All herbaceous food, when saturated with an excess of moisture, secreted while in a growing condition, becomes injurious to animal and insect life. This is especially and peculiarly the case with the silk-worm. Copious rains, with a continuance for days and weeks of a cloudy atmosphere, have the effect to surcharge the leaf of the mulberry with a watery, viscid, poisonous consistency, which, if fed to the worms, affects them with a kind of cholera, from which nearly the entire stock of worms thus fed will sometimes die within a few hours. It takes about six weeks for the silk-worm to pass through its four periods of moulting after hatching to be in readiness to spin its cocoons, and in order that the leaves shall be in a proper condition there should be no rain for one or two weeks prior to the time of hatching. Thus there are required seven or eight weeks of rainless skies in order that the silk-worm may enjoy its brief existence in perfect health.

Explosive electricity, incidental to rainy climates, coming suddenly and at uncertain periods, is, perhaps, more fatal in its effects upon the silk-worm than any malady caused by bad food. The shock of a single stroke of thunder

often destroys vast numbers of worms in a few moments, affecting them with a kind of apoplexy. The phenomena of rain and explosive electricity, prevailing with greater or less severity in the climate of Europe and the Atlantic States, is, I apprehend, one of the chief obstacles to complete success in silk culture in those countries, as it is palpably evident that in those seasons most exempt from rain and thunder, during the season of feeding the worms, the best results are obtained.

THE CLIMATE OF CALIFORNIA PECULIARLY FAVORABLE TO SILK CULTURE.

My friend, the Frenchman, has said: "We shall have silk-growing States." If an isothermal locality, entirely destitute of rains from May to November, with a meteorological condition in which there is no explosive electricity, should seem to be favorable, then the prediction that we shall have silk-growing will some time be verified. Enough is already known to warrant large outlays of capital in the Pacific States in the establishment of this lucrative and fascinating industry. During five years of experiment with the silk-worm in California, the party engaged in it states that he has never discovered a diseased worm except from accidental wounds or being bitten by ants, neither of which dangers are serious when proper caution is exercised in placing the legs of the tables on which the worms are fed in vessels containing water, thereby preventing the ant from gaining access to them.

The leaf of the mulberry being sufficiently matured by the 1st of May to feed the worm when first hatched, and continuing succulent until November, there are six months in which the business of raising the worms may be conducted; and allowing six weeks for each set of worms to mature, there can be raised four perfect crops in a season.

The worms, in the cocoonery spoken of, are fed by cutting the small branches of the mulberry trees from one to two feet in length and laying them on the tables in the form of a triangle, this being done twice each day, the successive layers forming quite a pyramid before the worm has accomplished its moultings and is ready to spin the cocoon, which it is permitted to do among the pile of dried sticks from which it has stripped the foliage, or it is given a cluster of sticks or a bundle of dry mustard stalks for that purpose.

Cocoons raised in California and sent to France for examination have been pronounced of superior excellence, and on measurement were found to give an average of four hundred yards of silk to the cocoon, exceeding European cocoons by from fifty to one hundred yards. It was argued from this fact that the worms must have enjoyed robust health; hence the eggs produced by the moths would be of superior excellence for breeding purposes in the silk-raising districts of Europe, where the worms, owing to various maladies, had become deteriorated. Large orders for silk-worm eggs have been received in California from the silk-growing establishments in France, and a limited quantity, sent as far as possible by an overland route, reached their destination in good condition, and the expectation that they would produce worms superior in health to the diseased progeny raised from the feeble stock of the cocooneries of Europe has been realized.

Throughout large districts of the State there are moist lands, some in course of reclamation for agricultural purposes, where the mulberry would flourish equally as well as the willow as a hedge for fencing. On such lands the mulberry could be planted as a stool, from two to three feet apart each way, and cut down as wanted for the worms, as is the practice in Hindostan. From two to three crops could be taken annually. In some of the vine-growing districts the vineyards are surrounded with live willow fences. If the *vigneron* would substitute the mulberry he would get rid of a vermin-breeding nuisance, and by allowing an occasional tree in the hedge to grow up, so as to fruit, he would

have something for the birds to feed on after they have exhausted the supply of insects, thereby saving his grapes, besides the means of raising so large a quantity of silk that it would challenge the returns from the vine in the season's results.

That the pabulum elaborated in the stomach of the silk-worm, from which it spins its fibrous enclosure, is of a superior character in the dry climate of California, is unquestionably due to the perfect maturity of the mulberry leaf on which it feeds; hence it may be expected that the silk will be of an even and strong texture, and of unequalled lustre. Much time, however, must necessarily elapse before silk culture will attain importance in the Pacific States, as the mulberry trees are not yet planted by which any considerable number of worms can be fed, nor are they likely to be propagated until old, deeply-seated prejudices against silk culture shall be uprooted by discussion, practical demonstration, and unwearied effort on the part of those who, by making the subject a specialty, at last find the usual reward of the pioneer in all public benefactions—thankless, unrequited service.

CONSULAR CORRESPONDENCE.

COMPILED BY J. R. DODGE, DEPARTMENT OF AGRICULTURE.

A SYSTEM of correspondence with our consuls abroad, designed to elicit information concerning the character and condition of foreign agriculture, and to procure an exchange of industrial statistics, has been initiated by the Department of Agriculture. Much statistical and current documentary matter, of great value for reference and casual use, in supplying special information in answer to frequent calls upon the Department, has been received. The consuls have generally manifested, not only a willingness, but a decided interest, and sometimes enthusiasm, in their efforts to render this service as valuable as possible. Much of this matter, though useful and indispensable to the office, is not of a character to spread upon the pages of the annual report. A selection, however, embracing recent or suggestive facts, or descriptions of soils, growths, and modes of culture not familiar to the masses of our rural population, will prove of interest to the general reader. A brief compilation of such matter is herewith given.

GASPÉ BASIN, CANADA EAST.

Thomas Fitnam, consul at Gaspé Basin, makes a statement of the productions of a portion of Lower Canada, little known. That northern clime produces fine potatoes, oats, and hay. Wheat and barley are only grown to a limited extent on the shores of the bay of Chaleurs. He reports a scarcity of hay and grain, from excessive rains in the latter part of the harvest season, and insufficient moisture in the early spring. A part of the forage supply is obtained from the spontaneous growth of lands that have never been broken with the plough, and have been cropped annually for thirty years or more.

Cape Chat is the northwest point of the district, on the river St. Lawrence; thence the settlements down the coast to Cape Gaspé, the most eastern point of Lower Canada, are few and poor, cod fishing being the principal employment. From this point, a distance of fifteen to twenty miles up the narrows at the entrance of the basin, the same absence of agricultural enterprise is

exhibited; but within the basin, seven or eight miles to tide-water, quite an improvement is observable. Westward from this point is unbroken wilderness, extending several hundred miles from the waters of the St. Lawrence to the bay of Chaleurs. Along the north shore of that beautiful bay the picturesque scene is pervaded with an air of comfort and independence comporting well with the kindness and hospitality of the people, among whom are families of refinement and education. The consul says of this region:

"Lower Canada, from the time you leave the 'parishes,' at Point Pere, or Father Point, down along the coasts, harbors, and inlets to the head of the bay of Chaleurs, is but a mere shell, extending in depth from the water-line inwards not more than one or two 'concessions'—a 'concession' being 33½ square acres in length, and either three or four square acres in front. From the narrowness of the front of each farm running along the sea and river shores, the dwellings and appurtenances come, consequently, into close proximity, and that is what gives these coasts the appearance of one continuous village, with a dense population, to one not acquainted with the country; whereas, by the census of 1860–'61, Gaspé county had only 7,415 souls; Bonaventure county 6,916; and the Magdalene islands about 3,000; or an average population of 17,331, leaving out the north shore of the St. Lawrence, which is void entirely of vegetation, and has only in the warm months a floating fishing population. All else is wilderness, inaccessible to settlers from the absence of colonization roads, which, from the financial state of the Canadian government, and unsettled condition of political affairs, must remain so for some time to come, although every effort is being made, and will be continued by the able and experienced head of the Agricultural Department of Canada, Hon. Thomas D'Arcy Magee, to promote immigration and settlement on the public lands, the price of which per acre, is only twenty cents. My opinion is that settlements would increase faster if the government were to take off the restrictions annexed to the granting of patents for lots, and make free grants of not more than forty or fifty acres to an actual settler, leaving to him full discretion as to time and quantity of clearance in proportion to the pecuniary resources at his command. The *habitans*, who predominate in Lower Canada—being descendants of the early French colonists—are an honest, hospitable, and unsophisticated religious class, and not much inclined to change, in either their social or political relations, so long as they can move along the road of life without over-exertion of body or mind, to improve their temporal prospects. But the offspring of the English and Scotch, who are the fewest, do more in the way of good farming than the French.

"Canada, if not all the other British North American provinces, being at this time, apparently, in a state of transition from a colonial dependence to one of a national status—whether monarchical or republican I cannot say—will, when the end at which she is aiming shall have been reached, give a fresh impulse to all branches of industry which the innate power and self-reliance of an independent people are sure to develop in a greater degree than they ever could as an appendage to ever so great or liberal a power. Then these valleys and mountains, at present so unproductive of all material resources, will grow grain enough to feed a numerous and hardy population; and the long winters, the great drawback to early and successful agricultural pursuits, will become shortened and ameliorated as the forests fall before the axe of the husbandman; and the deep snows which linger in them, cooling and keeping the surrounding atmosphere at a temperature uncongenial to farming operations long after they have been in a state of forwardness on cleared lands, will melt away under the cheering rays of the summer's sun."

SONORA.

Farrelly Alden, esq., consul at Guaymas, writes:

"Sonora is doubtless the most barren state of Mexico, excepting Abaja, California. Her small extent of constantly cultivated lands consists of choice overflowed and irrigated strips along the rivers, never failing to produce two good crops annually of the staples—corn, peas, beans, wheat, and various other crops, such as sugar-cane, barley, potatoes, and such fruits as grapes, figs, dates, pears, peaches, quinces, and many others.

"Corn and beans are planted during the rainy season of three months, commencing the last of June; and a crop of peas and wheat during the cold and dry months. Manure is never applied, although guano by the thousands of tons has been shipped from the gulf. The virgin sub-soil is undisturbed by the surface scratchings of their primitive ploughs, although the best modern ploughs have been shown to do more service than eight native implements. In fact, modern improved implements of husbandry are almost unknown.

"All seeds are sown in rows of irregular hills, the after cultivation nothing more than the hacking down of tall weeds: a clumsy hook-knife, fastened to a long handle, is the only implement used in after culture. The grain is harvested with a sheath-knife, with which a handful of wheat heads are cut at a time. The grain is immediately tramped out on a hard prepared earthen floor, and winnowed by tossing in the breeze.

"The irrigated and overflowed lands are in few hands, and are cultivated; except on the Yagui and Mayo rivers, which comprise really more than half the choice lands in the state, and are held exclusively by the Indians, who are too jealous to permit any white man to reap

the fruits of his labor on their territory. The Yaguis and Mayos steal the stock and the crops, while the Apaches everywhere take the scalp and make stock raids like the rebels themselves.

"About 800 tons of flour are exported coastwise, and during ordinary seasons corn is imported from San Blas and intermediate ports. About every fourth summer rains are sufficiently copious to insure crops on 'los tierras temporales,' (lands dependent upon the seasons,) when there is a surplus of corn, and its price is reduced to 75 cents per hundredweight, which, during ordinary seasons, readily commands $2 25 to $3.

"The immense herds of cattle, horses and mules that fed upon a thousand hills during the iron rule of Spain have dwindled down to scores in place of thousands. Formerly, full-grown grass-fed steers were sold at $3 to be slaughtered for the hide and tallow; now they command $20 to $25 for beef to eat! The insecurity of life and property, owing to intestine wars, thieving peons, unjustly administered laws, and daily Apache raids, account for the change.

"The crops last year and the present have been ordinary, being limited entirely to the overflowed and irrigated lands; and the wholesale price for corn is $2 25 per cwt.; flour, $5; red beans, $4 50; white beans, $3; brown sugar, $10; seed cotton, $11; and other products in proportion.

"Under the enlightened government of the United States Sonora is capable of prosperously supporting ten times her present supposed population of 100,000 souls. Below the foot-hills of Sierra Nevada the alluvial lands on the Yagui and Mayo rivers open into one vast plain of at least one million acres capable of being irrigated, and producing enough to feed the republic."

PITA FIBRE.

B. L. Hill, esq., consul at Corinto, Nicaragua, has forwarded a specimen of the *pita* fibre—from a species of *agave* or aloe, the leaves of which are macerated to obtain the longitudinal fibre of their structure—of which the consul says:

"It grows in great abundance spontaneously in all this region. It seems to me to be a most valuable article for the manufacture of cordage. It is very cheap, and could be taken to the United States and sold much lower than the Manilla, so much used, and is as good, if not better, for all such purposes."

DYE AND CABINET WOODS OF HONDURAS.

This portion of British America, one of the discoveries of Columbus, has a low coast, studded with numerous islands. From the coast the land rises into bold heights, and is diversified with rivers and lagoons, and rapids and waterfalls, amid the most vigorous verdure and the most gigantic forests.

With all this excess of vegetable life, there is no lack of animal forms, embracing the jaguar, capybara, armadillo, large weasel, opossum, deer, wild turkeys, pheasants, pigeons, plovers, and myriads of insects. Sea-fowl hover over the waters of the coast, fish abound in them, the green turtle attains aldermanic proportions, and alligators flourish.

Among the fruits are oranges, shaddocks, limes, mangoes, melons, pine-apples, watermelons, avocata pears, cocoanuts, and many others.

With a soil claimed to be unsurpassed in the world, and a tropical climate, suited to the growth of the most valuable vegetable products, it does not produce food enough for the consumption of its people, who, so far as they engage in any industry, are occupied with the cutting and export of mahogany and logwood. Mahogany is best grown on elevated situations, where it is conspicuous from its yellow foliage. Its boughs afford the finest wood, but size is a matter of prime importance. The logwood is found at the water's edge, its spreading roots producing the most valuable dye-wood. Pine, containing an immense percentage of turpentine, is also found here.

Besides these woods the exports are trifling, including rosewood, hides, tortoise-shell, fustic, cochineal, indigo, sarsaparilla, and cocoanuts—all of the latter not being products of the province, but goods in transitu from Yucatan.

The consul, Charles A Leas, at Balize, Honduras, says: "The old Scotch pirates were drawn hither, after the termination of the system of plundering the

Spanish merchantmen had ceased to be a lawful pursuit, in search of logwood, which had accidentally been discovered to possess valuable dyeing properties. They maintained themselves, in obtaining this wood, by a system of plunder, for a period of over one hundred years, against the efforts of the authorities of Spain to dislodge them. Indeed, when Spain found that she was unable to rid herself of these troublesome customers, she entered into a convention with Great Britain, allowing the settlers to cut and export wood, but not to cultivate the soil, except for the purposes of food for the settlers. It was expressly provided that nothing should be cultivated for sale or exportation. So the entire trade of the country, until about the year 1800, consisted of the cutting and exporting of logwood, and the importing of a few dry goods and provisions. At about this period the mahogany tree was discovered to yield a valuable wood for cabinet purposes, and in a new convention which was entered into with Spain, the cutting and exporting of that wood was allowed, and the wood was admitted also as a circulating medium in the payment of debts and adjustment of balances, as logwood had previously been. Still no cultivation of the soil was allowed. Grants of land were made by the British authorities, but only for the purpose of cutting-timber. As the English government did not consider herself as possessing *de facto* the country, she refused to make grants of land for the purposes of cultivation; hence, no cultivation was attempted, save that of a few plantains, yams, bananas, oranges, &c., until after the signing of the Clayton-Bulwer treaty. Then it was that England, feeling safe in the possession of the soil, commenced the sale of the soil.

"In the mean time two things had arisen to defeat any extensive effort to cultivate the soil: slavery had been abolished, and the colored population, finding itself free in a country of eternal summer, in which but little energy sufficed to maintain the connexion between soul and body, sank into a state of almost utter degradation; while the few whites, or Europeans, who resided in the country, were only interested in the articles of logwood and mahogany, contented to amass fortunes in the export of those woods. Thousands of laborers were employed in this businsss, at from six to eight dollars and rations per month, the rations consisting of seven pounds of flour and four pounds of pork per week.

"At the commencement of the American rebellion, when cotton, sugar, rice, and tobacco began to command fabulous prices, and cabinet and dyewoods bebecame somewhat scarce, it was discovered that, unless some vigorous effort should be made to bring the soil into cultivation, the whole country would soon come to grief. It was not difficult to discover that this rich, black soil, resulting from the decomposition of vegetable matter for thousands of years, was admirably adapted to the cultivation of those very articles which had so enriched the United States. And at once these wealthy Europeans commenced to dream of untold wealth; they imagined they could see the wharves lined and groaning under the cotton bales, and sugar and tobacco hogsheads, and that the day was not far distant when 'John Bull' could set 'Uncle Sam' at defiance in these respects. But, alas! for this as well as other human calculations! It was now discovered that the laboring population had been trained to nothing but cutting wood, and that they were too much demoralized to be trained to these pursuits; hence they sought aid from the United States, by desiring a few thousand 'contrabands,' who were well educated in the cultivation of those articles; but this failed, and this wild jungle was in a fair way to remain wild yet a few years longer.

"During the past year (1864) some Americans came here and commenced the cultivation of cotton, which promised great success for a season, but the appearance of a destructive worm caused an abandonment of the cultivation. A few have succeeded, and are doing very well, raising two crops per year; but it is extremely doubtful, in view of the many enemies of the plant existing

in the country, such as worms, heavy rains, &c., whether it can really be successfully cultivated after the termination of the war. The cane product is very abundant, yielding four tons to the acre. Rice and tobacco are beginning to be cultivated, mainly by Americans. If there were a few hundred capitalists here, with a few thousand colored men who really know how to work, this rich country would soon look like a vast garden, and the obstacles that now exist would soon disappear.

"The greatest difficulty exists in the climate, which is such that the white man cannot labor in the sun—attempts persisted in a few months often proving fatal; and the black man has no money, energy, or disposition to engage in extensive cultivation, with few exceptions, which becomes too expensive for profit. As an example, no black laborer will consent to pick more than twenty or thirty pounds of cotton per day, while in the United States one hundred and fifty to two hundred pounds are picked as an ordinary day's work."

COFFEE IN NICARAGUA.

From B. L. Hill, consul at San Juan del Sur, writing from Corinto, is received a statement of coffee production in Nicaragua, with samples of a superior quality. He deems its cultivation there a perfect success, yielding successive crops without a failure, which are quite large for the number of trees in bearing. Neither insects nor climatic influences have as yet interfered with successful growth or production.

He describes a visit to a new coffee estate, not quite eighteen months from planting, (of the seed,) on which the yield was from one-fourth to three-fourths of a pound per tree. The trees are generally full grown at four years old, when, if well cared for, kept clear of vines, and properly pruned, they will yield about three pounds to the tree. They are planted nine hundred trees to the acre, a fine yield thus giving not far from two thousand pounds per acre. A general interest in coffee culture is excited, and plantations are rapidly increasing, mainly under the proprietorship of Europeans and Americans.

The business would be greatly extended were there treaties in existence for the proper protection of Americans in their rights of property, such as have been obtained by England, France and Italy.

The plant, which is an evergreen, is thus described by La Roque:

"The coffee tree is from six to twelve feet high; the stem ten, twelve, and fifteen inches in circumference. When it is full grown it much resembles in figure our apple trees of eight or ten years' standing. The lower branches ordinarily bend when the tree begins to grow old, and extend themselves into a round form, somewhat like an umbrella; and the wood is so very limber and pliable that the ends of the longest branches may be bent down within two or three feet of the earth. The bark is whitish, and somewhat rough; its leaf is much like that of the citron tree. It continues green all the year, and the tree is never without leaves, which are ranged almost opposite on each side of the bough, and at small distances from each other. Nothing is more singular in its kind than its productions; for almost in all seasons of the year blossoms and green and ripe fruit, may be seen on the same tree at the same time. When the blossoms fall off there remains in its room, or rather springs from each blossom, a small fruit, green at first, but which becomes red as it ripens, and is not unlike a large cherry, and is very good to eat. Under the flesh of this cherry, instead of this stone, is found the bean or berry we call coffee, wrapped round in a fine thin skin. The berry is then very soft, and of a disagreeable taste; but as the cherry ripens, the berry in the inside grows harder, and the dried-up fruit being the flesh or pulp of it, which was before eatable, becomes a shell or pod of a deep brown color. The berry is now solid, and of a clear transparent green.

Each shell contains one berry, which splits into two equal parts. When the fruit is sufficiently ripe to be shaken from the tree, the husks are separated from the berries, and are used by the natives, while the berries are exported."

COTTON AND OTHER BRAZILIAN PRODUCTS.

James Monroe, esq., consul at Rio de Janeiro, Brazil, writing under date of December 1, 1864, represents the last crop of coffee, a crop which absorbs a very large proportion of the agricultural effort of that country, as a very good one, exceeding the expectation of growers, amounting to 2,000,000 bags, in the province of Rio de Janeiro. Of this, 850,000 bags have already been exported, leaving 1,150,000 bags still to be exported, with the exception of what may be required for home consumption.

"The coffee for next year's harvest blossomed towards the end of October. The berry is now everywhere set, and in many places is half grown. On the whole, it does not promise as large a crop for next year as that which was harvested this year. It is hoped, however, that it will not fall much below the average.

"In the higher regions of the province maize is cultivated. It is now in all stages of advancement—in some fields just breaking the ground, while in others the stalks bend with the full ear. It can never attain the perfection which belongs to it in the United States, nor will it ever be very widely cultivated. Still it is a useful crop.

"In some fields you see the Indian corn and the cotton plant in alternate rows. Yet, notwithstanding the strong inducement for raising the cotton which is furnished by the high price of the article, not much progress in cotton culture has been made in this province; which proves, I think, that the soil is not well adapted to the purpose. Other provinces of Brazil, such as Maranham, Cora and San Paulo, are doing much better.

"I notice that the Danish brig Anna Jane brought into this port from New York on the 27th ultimo 169 barrels of cotton seed for the Brazilian government."

COTTON IN PANAMA.

Alexander R. McKee, esq., consul at Panama, writes that a spirit of agricultural improvement is rife there, and that an attempt is being made to cultivate cotton, thus far with flattering success. President Santacoloma has given earnest efforts for the development of this important experiment, and proposes to continue the attempt to make it a staple product of the country.

The cultivation of sugar has been attended with good success. A Doctor Kratochvill, a naturalized American, is referred to as a practical grower and manufacturer, who has pursued his experiment with unprecedented profit.

COTTON IN PERU.

An impetus to cotton culture, even in Peru, has resulted from the necessities of the English market in the continued absence of cotton from the United States. Its culture became extensive among the Indians that flourished under the rule of the Incas, but declined and was wholly neglected under the control of the Spanish invaders and conquerors. Yet it continued to flourish as a wild plant in a soil and climate naturally adapted to its growth. In favorable localities it is now found a tree twenty to twenty-five feet in height, of considerable breadth, yielding large biennial crops for ten or twelve consecutive years.

This spontaneous growth, under the pressing demands of commerce, was seized upon by enterprising persons early in the progress of the rebellion, collected at an expense of six to eight cents per pound, and a fine profit realized in its export. Samples of this cotton, of good quality, have been received in this department.

The following account of this enterprise is furnished by our consul at Paita, C. F. Winslow, esq.:

"After collecting the wild staple, at cheap rates, and exporting it for trial upon British looms, an enterprising English gentleman employed the services of our mechanical and civil engineer, Alfred Duvall, of Baltimore, who has already written a valuable treatise upon the subject, to lay out a plantation in the rich valley of the Chira, about twenty-five miles from this port. The valley of the Chira is a rich bottom, averaging more than two miles in width, extending from the bay to the Andes, and capable of irrigation from a small river that flows through its rich alluvial deposits. The Chira is perhaps the longest river, and the valley perhaps the finest soil for cultivation of cotton on the western sides of the Andes. This spot was selected, and by a free outlay of capital several hundred acres of land, neglected wilderness, have been converted into magnificent and productive cotton lands in an incredibly short time. The water is raised by expensive machinery and led by ingenious devices and gigantic causeways in such a manner as to insure abundant crops by unfailing irrigation.

"Although it has not been two years since the first blow was struck upon the virgin soil, the next steamer, I am informed, will take back to England a quantity of cotton valued at from $10,000 to $15,000. This is the first picking from cotton plants grown from seed planted within nine months.

"Meanwhile the purchase of wild cotton, in the interior of the country, gradually advancing from six to twenty cents per pound, has stimulated the Indians to send to market all the products of wild plants, and to plant the seed in favorable localities; and the successful operations of Messrs. Garland and Duvall, in the valley of the Chira, have encouraged the initiation of similar enterprises with Peruvian capital in all the valleys favorable to its cultivation that skirt the Andes.

"In a recent visit which I made to the great Synclinal valley of the Andes, as far as Huancabamba, one of the sources of the Amazon, after passing almost ninety miles of trackless deserts of drifting sand, I came to the fertile regions that open between the spurs of the Cordilleras. These are laid out into large estates called haciendas, embracing mountains, slopes, and valleys, with climate varying with altitude, and adapted to the cultivation of all classes of vegetable products. The valleys, which ascend with the gentlest inclination, are fitted for all tropical productions, and the recent experiments with cotton show them to be especially adapted by their soil, by periodical rains, and facilities for irrigation, to the culture of this staple on a vast scale.

"In many places it is merely necessary to repair the canals of the Incas, some of which extended for leagues and watered immense districts, while in other places canals are being now made at great expense.

"At Carrasquilla there is a gigantic enterprise of this character nearly completed. This canal, at least six feet in width, is cut through the first portions of its course through rock and rocky debris from twenty to thirty feet in depth, and extends six miles. It is intended to irrigate the lower regions of the valley for the exclusive cultivation of cotton.

"Further up the district of Salatral, Don Antonio Guena has commenced the planting of cotton, which has already begun to yield abundantly.

"The Egyptian and sea island cotton grow in all these plantations with improved fineness and length of staple, and the cotton is becoming, by cultivation and mixing, much improved in quality and value.

"The cost of transporting cotton from these remote interior regions on the backs of mules to the seaport of Paita is from four to five dollars per cargo of 350 pounds.

"It will thus be seen that when the machinery for cleaning cotton is introduced in Peru, and enterprises already commenced and in prospect are well established, with persistent and well-directed industry this consular district must become an important locality for the exportation of this useful staple.

"A new enterprise is now about to be undertaken lower down upon the river Chira than Monte Abierto, on the plantation of Mr. Garland, by the united operations of Alexander Black, the British consul, and Alfred Duvall, of Baltimore, whose engineering capabilities have for some ten years past been employed by the Peruvian government with eminently successful results.

"The Egyptian cotton plant, when once started, grows thriftily, and in four months begins to yield. The native cotton yields in eight months. Bolls open every successive day, so that picking on large plantations will be a continuous labor. It is said that there are two seasons to the yield of the wild cotton, and that the trees continue to thrive for ten years. The cultivated cotton of foreign varieties seems to differ from this habit of periodicity, unfolds a continuous harvest, and becomes perennial.

"VALLEY OF THE HUANCABAMBA.

"Having thus written of the agricultural capabilities of the valleys that penetrate the spurs of the Cordilleras on this side of the continent, I will say a word of the capacities of the great Synclinal valley of the Andes, in this latitude. I found the Andes clothed with vegetation throughout my ascent, and the summits of the Pacific Cordilleras, instead of being

peaked like the lower ridges, with projections of barren rocks, are as beautifully rounded and verdant with grass and shrubs as the hills of Vermont. Cattle were roaming and grazing not far from the main passes of the Sierra.

"But, on reaching the summit, the eye at once stretches eastward over an immense valley of from thirty to forty miles in width to another ridge or range of mountains whose eastern faces slope down into the plains of Brazil. Between these ranges is the great Synclinal valley of which I speak, at the bottom of which flows the river Huancabamba, one of the head-waters of the Amazon. The view is grand, and the fertility of the region immediately becomes a most impressive conviction.

"On descending I was struck with the abundance and luxuriance of great varieties of new plants and flowers. But the most remarkable thing was the extensive cultivation of this great region by the Indian population. The slopes and bottom of the valley, seen from high points, were cut up into plantations and gardens. The climate is mild, rains are frequent, the periodical rains unfailing, and channels for irrigation were babbling everywhere. The soil is rich, and there is no fruit, nor plant, nor tree, which might not be there cultivated with success.

"Cochineal and Peruvian bark are obtained in these regions. Flax abounds of the finest quality. I have no doubt cotton could be largely cultivated. The great drawback, however, in these interior regions, is the difficulty of transportation of all agricultural products to the sea-coast. But so magnificent and luxurious a country, with so mild and salubrious a climate, I have rarely seen equalled in extensive travels over the globe."

COTTON AND SUGAR OF PERNAMBUCO.

Thomas Adamson, jr., esq., United States consul at Pernambuco, furnishes a few statements concerning the crops of that province, of which sugar is the most valuable. In the last two or three years the product has decreased, in consequence of severe droughts. The system of culture is the same that was practiced a hundred years ago, with the exception of a few estates upon which the plough has taken the place of the hoe. In some instances improvements have been made in setting sugar pans, in economy of fuel, and perhaps in distilling rum from molasses.

The receipts for last year were 661,000 bags of 160 pounds each, or 105,760,000 pounds. This was somewhat less than the average.

The increase of the cotton crop, which encroached somewhat upon the sugar, was marked. For the year ending June 30, 1862, the exports were 25,000 bales; 52,000 the next year, and 80,000 last year.

He states that cotton culture has been stimulated by its high price, and that nine-tenths of it is now cultivated by free labor—by a class of poor people, small farmers, called *moradores*, or squatters. They produce only a few arrobas to each family, just enough to supply them with a little clothing and the very few necessaries of life which nature does not produce spontaneously for them. A capacity for an enormous increase exists, dependent only on careful cultivation. Probably there is not a plough employed in cotton culture in the province. The mode of procedure is this: The ground is charred by cutting down and burning the dense vegetation which covers it; holes, four or five feet apart, are made with a hoe; the seed is dropped in and covered with a push and stamp of the foot; and nature does the rest. Cotton is here a perennial. It gives its best crop in the third year; in the fourth the yield is smaller, and in the fifth it is generally cut down and replanted.

The quantity of cotton exported in 1864 was four times the export of 1859, and brought ten times as much money. The consul says:

"This empire possesses the natural advantages of a soil and climate excellently well adapted to the cultivation of cotton, and if the people were generally energetic and intelligent they might make Brazil one of the greatest sources of cotton supply for the world; but it is hardly probable that they will improve their resources to any great extent during this century. I believe they will cease to compete with us, to any great extent, if we resume our former production before they become rich enough to have acquired many new wants."

THE YUCCA.

Among the specimens of useful plants received at this department should be mentioned a package of the yucca, a member of the liliaceous family, the bulb

or root of which is edible, nutritive, of delicious flavor, cultivated or growing spontaneously in almost all intertropical countries. These specimens were received from Consul Winslow, of Paita, Peru. He says of it:

"I first tasted it in 1843, in the Cape Verde islands, and in Brazil I again enjoyed it in 1848; and in this country it is a staple article of food for the natives of the interior and the sea-coast. If the stalks I send are cut into pieces two or three inches long and planted, and not too much watered, and kept at ordinary tropical temperatures, I think they will thrive. The root is eaten when two inches in diameter, and is fine at all sizes. Some will reach the weight of twenty pounds and more. The largest I have seen have been as large as a stout man's leg from the hip to the knee. The tuber is boiled, roasted or baked.

"I also send the stalks of a beautiful flowering plant which I met with in a garden the other day in the valley of the Chira, some twenty-five miles distant. I do not know the name of it. It has a beautiful terminal red flower, looking like painted wax. I hope the plant will live and grow in your green-houses."

LOBOS ISLANDS GUANO.

Information received from C. F. Winslow, esq., United States consul at Paita, Peru, confirms the opinion of merchants and speculators, that the guano beds of the Lobos islands might be worked, sold, and exported to foreign countries, and that the trade might give to Paita something of the commercial importance which the Chincha islands have given to Callao. But obstacles have hitherto obstructed this enterprise. Fresh water, for the supply of population, could not be had, and the geological structure of the coast is understood to render problematical efforts to obtain it. Nor are these difficulties met by the government with sufficient persistence.

The repulsiveness of the landscape here is somewhat compensated by the commodiousness of the bay and the agreeableness of the climate. Want of fresh water has hitherto prevented its becoming a place of considerable importance. It has, to some extent, been the resort of the whaling fleet of New England, for allowing recreation to seamen after long and tedious cruises, for seeking medical and surgical relief, and for obtaining vegetables, especially the onion—the most valuable anti-scorbutic—grown in the interior of this portion of the coast.

AGRICULTURE OF SWEDEN.

W. W. Thomas, jr., esq., consul at Gothenburg, Sweden, communicates the following:

"No later statistics of the agricultural productions of Sweden than those of 1861 can now be obtained. I am, therefore, unable to answer your questions in regard to 1862 and 1863. The latest volume of Swedish official statistics that has as yet been made public treats of the five years from 1856 to 1860, inclusive, and is rather a *résumè* of those five years, considered as one period, than a detailed account of each year by itself. From this I have compiled the following table, showing, first, the average yearly amount of agricultural productions after deducting the amount of seed for the next year; second, the average yearly amount of seed so deducted; and, third, the average yearly total:

Articles.	For consumption.	For seed.	Total.
Wheat....tunns*	509,148	66,829	576,077
Rye	3,763,766	568,891	4,332,657
Barley	2,268,419	474,722	3,143,141
Oats	4,677,204	979,124	5,656,328
Mixed oats and barley	1,208,944	216,863	1,424,807
Peas and beans	391,350	....	....
Potatoes	7,985,607	1,271,143	9,256,752
Other edible roots	826,301	....	....
Flax and hemp....centners†	46,249	....	....

* One tunn equals four bushels English. † One centner equals 93 lbs. English.

"The foregoing statistics are, of course, only approximate. Until every farmer is sufficiently educated and willing to keep an exact account of every article raised by himself, no exact data of the agricultural productions of a country can be obtained. I believe, however, that these statistics are as reliable as those of any other country on the same subject.

"About 1,500,000 Swedish acres* are devoted to growing grain, and 100,000 acres to potatoes, yet the yield of potatoes is so large that it stands in relation to the entire grain crop as three to five. The potatoes are, indeed, the 'staff of life' to the Swedish peasant; they can be raised in the short summer of these high northern latitudes, where no grain, save perhaps barley, can live. In the valley of the Alten river, and on the banks of the Alten Fjord, far within the Arctic circle, even above 70° north latitude, fair crops of potatoes, with some barley, are frequently produced. This is the highest cultivated land in the world."

From the data furnished by the consul the following table of Swedish exports and imports is condensed:

IMPORTS.

Year.	Wheat.	Rye.	Barley.	Oats.	Peas.
1855	2,470	40,622	3,676	352	90
1856	99,844	497,886	53,131	7,213	19,918
1857	71,311	391,942	73,548	9,433	15,760
1858	37,765	53,079	3,379	1,357	701
1859	20,488	41,954	9,397	1,523	179
1860	24,315	70,787	4,908	1,980	120
1861	36,914	620,403	21,903	3,737	4,439

EXPORTS.

Year.	Wheat.	Rye.	Barley.	Oats.	Peas.
1855	86,147	744,428	247,195	649,432	25,971
1856	30,668	294,431	113,704	407,672	7,305
1857	17,416	34,862	187,459	622,111	8,115
1858	39,769	139,192	236,472	957,555	9,294
1859	84,319	143,607	322,079	1,039,543	37,649
1860	97,444	235,572	429,900	1,000,959	25,630
1861	74,802	20,926	254,372	1,174,342	12,353

It will be seen from the above table that Sweden is a grain-exporting country, though in a small degree.

"I know not if we have the Alsike clover in America; it is the most productive clover in Sweden, cuts about five tons to the Swedish acre, can be made to yield two crops in the short Swedish summer, and has been introduced into Scotland to great advantage."

He thus writes concerning the grapes of Scutari and Moldavia:

"Scutari is a village on the Asiatic shore of the Bosphorus, opposite Constantinople. There is a very large, long, translucent grape, which hangs in heavy golden clusters there. This I have heard universally pronounced, by hundreds of travellers and connoisseurs, the best grape in the world; for myself I can conceive of nothing superior. I believe this grape would flourish in our middle States, and in those States bordering on the Ohio river.

"In regard to the grapes of Moldavia, good grapes of both white and purple varieties are produced in great profusion. These would not of themselves require particular notice were it not for the severe cold which the vines pass through every winter. In the winter of 1862-'63, which was unusually mild, the thermometer at Galatz, the southern point of Moldavia indicated one morning 17° below zero, Fahrenheit, and frequently fell to 12° and 15° below. This cold will certainly rival that of our most southern States, and the fact of the vines enduring it, with little or no shelter, has led me to suppose that they might be successfully cultivated in the open air in the most northern parts of the United States, where the cultivation of grapes would be impossible."

*26 Swedish acres equal 32 English.

It is very doubtful whether these grapes would flourish here. No European grapes have as yet succeeded, in the open air, in this country, except in California.

EXPORTS OF DENMARK IN 1862.

George P. Hansen, esq., consul at Elsinore, sends the following table:

Articles.	Kingdom.	Duchy of Sleswig.	Duchy of Holstein.	Enclave of Lubec.	Total.
Bones of animals.....lbs.	3,015,340	1,536,880	1,292,142	22,341	5,866,703
Barley...............bbls.	1,140,028	17,582	57,405	427	1,215,442
Beef..................lbs.	1,436,255	481,973	723,171	2,667	2,644,066
Bread ....lbs.	1,738,900	29,088	622,628	65	2,390,681
Butter...............bbls.	26,236	5,391	67,751	309	99,687
Buckwheat ... .bbls.	17,628	39,457	24,842	296	82,223
Cattle........... number.	453	24,679	26,807	358	52,297
Calves ....do...	8	2	12,560	753	13,327
Flour, (of wheat) ..... lbs.	7,135,524	350,579	6,772,603	27,096	14,285,802
other kinds.....lbs.	2,765,259	188,317	417,941	14,853	3,386,370
Groats, (wheat).......lbs.	1,673	6,456	....	....	8,129
other kinds.....lbs.	5,756,663	523,034	1,414,617	36,800	7,731,114
Horses ....number.	202	3,587	9,805	161	13,755
Hogs ....do...	2,244	27	44,166	2,146	48,583
Malt ....bbls.	5,298	322	3,259	....	8,879
Oats.................bbls.	633,559	54,108	140,458	200	828,325
Oil-cake ....lbs.	8,069,893	3,916,695	4,944,506	....	16,931,094
Peas ....bbls.	16,212	1,717	8,659	919	27,507
Pork ....lbs.	2,054,192	1,168,707	573,592	1,393	3,797,884
Rye ....bbls.	119,321	3,171	40,235	349	163,076
Rape-seed ....bbls.	55,715	55,815	139,950	1,746	253,226
Skins and hides ...... lbs.	2,274,925	459,340	1,047,283	28,999	3,810,547
Vetch ....bbls.	8,585	69	2,658	25	11,337
Wheat...............bbls.	226,169	58,084	204,577	2,841	491,671
Wool, coarse ....lbs.	1,626,373	49,285	142,690	534	1,818,882
other kinds.....lbs.	2,089,296	537,413	120,988	21,089	2,768,786

NOTE.—A barrel (if butter) is 246.92 pounds; a pound is 1.1023 pound avoirdupois; a centner is 100 pounds; a gallon is $4\frac{7}{16}$ potter.

DECREASE OF PRODUCTION IN IRELAND.

John Young, esq., consul at Belfast, Ireland, communicates facts illustrative of the condition of Irish agriculture, from which it appears, as has before been intimated, that the tillage of that country is rapidly decreasing. In wheat, especially, the decline is marked. In 1847 the product was 23,408,000 bushels; in 1850, 17,344,000; in 1862, 5,464,000 bushels. There has also been a decrease of barley, oats, and rye to nearly the same extent. This decadence is attributable to the removal of prohibitory duties from the importation of foreign grain; to the loss of one-third of the population by emigration to the United States and British colonies; and to the recently inaugurated policy of driving off agricultural laborers and converting the lands into grazing farms.

The consul says:

"It appears that the rulers of Ireland are quite willing to see the native or Milesian population exterminated, but are becoming very anxious to extend the growth of fat bullocks by which John Bull can be furnished with a full supply of roast beef. The reason is, that a bullock is more easily governed and is less rebellious than an Irish Celt. A second inference from the above facts is, that the poverty of the laboring population who remain has not been materially decreased by the vast emigration. This is proved by the existence of an

increase, during fifteen years, in the quantity of potatoes cultivated in Ireland, though the population is diminished—the only article of food on which a starving population can be subsisted by the outlay of little money or workhouse relief; and the extent of its cultivation forms an index of the poverty of the people.

"During the first seven months of this year, 1863, 80,000 persons left Ireland by emigration; but it is satisfactory to notice that, from 1862 to 1863, there has been an increase of 12,700 cattle under two years old, and 19,000 under one year old."

The average of the several crops for 1863 is thus given:

	Acres.
Wheat	264, 000
Oats	1, 940, 000
Potatoes	1, 023, 000
Barley	171, 000
Flax	213, 000
Turnips	351, 000
Meadows and clover	1, 560, 000

The area in wheat is shown to have decreased, in five years, from 460,000 to 264,000 acres. The diminution is so large and rapid that little prospect is left of diminished dependence upon foreign supplies.

There has been an increase, however, in certain products—potatoes, hay, and especially flax—(which is shown more fully in the article on flax.) "The cotton scarcity yet operates to increase the culture of flax. Yet, with all the demand, Irish farmers, always slow to change agricultural habits, have failed to meet it. The town of Belfast has risen to its present wealth and beauty mainly by the linen trade. Orders are still flowing in to the manufacturers, but their ability to meet the demand is held in check by the small quantity of flax produced. The machinery is here, the active capital ready, but flax enough is not grown either in Ireland or elsewhere. Why should not the farmers of the United States raise flax for export to this country? Flax can be cultivated in America, exported here, manufactured, and returned there, just as cotton was before. * * * Mills for scutching it must also be provided, but as the American people have thus far excelled all other nations in improvements in machinery, they can be introduced as soon as the cultivation is fairly commenced. Great efforts are making at this time to introduce the cultivation of flax into Canada. In this important step towards national wealth I am confident our own country will not be left behind, and that it is only requisite for our people to know that there is a demand to induce them to furnish a supply."

AGRICULTURAL EXPORTS OF RUSSIA.

Timothy C. Smith, esq., consul at Odessa, has procured for the department, in the absence of reliable estimates of the total production of cereals of Russia, the facts of her exports of the principal products of agriculture, as well as the portion sent abroad from the port of Odessa, and the total from the southern ports, as follows:

Statement of exports from Russia during five years, from 1857 *to* 1862, *inclusive.*

	From Russia.	From southern ports.	From Odessa.
Wheat .... bushels.	119,383,752	94,512,072	36,003,030
Rye .... do...	53,479,396	7,812,216	6,645,792
Barley .... do...	24,338,544	14,077,050	11,498,028
Oats .... do...	53,404,554	15,958,458	13,647,162
Peas .... do...	2,050,002	698,184	698,082
Corn .... do...	13,271,592	12,110,380	12,040,842
Flour meal .... do...	5,766,780	1,868,904	1,101,744
Linseed and rapeseed .... do...	44,583,786	20,983,296	7,300,086
Total grains	316,278,306	168,020,560	88,934,766
Tallow .... tons.	323,209	48,842	33,706
Wool .... do..	98,833	45,543	22,137
Total value of exports	$828,000,000	$270,807,171	$146,874,309

FORAGE PLANTS IN PRUSSIA.

Charles J. Lundel, esq., consul at Stettin, Prussia, in his correspondence with the department, calls attention to the practicability of establishing a system of telegraphic weather reports, as suggested by the astronomer Dove, for the benefit of the agricultural interests, all over the different states of the German confederation. He thus refers to the yellow lupine:

"I would mention a kind of black 'peas,' used for feeding sheep and cattle, called 'lupinen,' which thrive well on even the poorest soil, and require but a short season for ripening. Having some years since been travelling on the upper peninsula of the State of Michigan, and noticed the promise of its soil, it strikes me that 'lupinen' might be profitably introduced there, and in other similar parts of the United States. An entirely new feeding plant here is the 'seradella,' which also grows to advantage on poor soil, is fed green or dried, and is similar to clover."

TOBACCO IN ITALY.

Hon. George P. Marsh, United States minister to Italy, resident at Turin, writes relative to the interest in tobacco culture in the vicinity of Turin, and desires from the department "a sufficient quantity of Virginia and Kentucky tobacco seed to produce half a million of plants." He also asks, at the intimation of the Royal Academy of Agriculture at Turin, information on the following subjects:

"Exact information on the character and chemical composition of the soils devoted to the cultivation of Virginia, Maryland, and Kentucky.

"The degree, maximum, medium. and minimum, of temperature and humidity, in those states during the year.

"The system of improvement (draining, manuring, &c.) of the soil.

"The inorganic matters absorbed by tobacco in greatest quantity.

"The depth of vegetable soil (humus) in the tobacco plantations.

"And other important information on the cultivation of tobacco, whether as it regards the natural conditions of soil and climate, the agricultural processes. or the modes of curing and preparing for market."

In reply to these queries, communication was made of facts and experiences in possession of the department, with original suggestions further elucidating the subject.

WINE CROP OF FRANCE.

L. W. Viollier, vice-consul at Lyons, France, under date of October 4, 1864, says:

"Serious fears are entertained about the wine crop; the great heat through the summer, it was thought had caused the oidium to make its appearance in several places, and the want of rain or fogs prevented the full growth of the grapes. Frequent and ample applications of sulphur have stopped the oidium, and the crop just gathered is above the average. The quality, as far as can be judged at present, is good; better than last year. In consequence, the prices are firm. The crop has not been equal everywhere; in some localities it is under the average, whilst in some others the quantity of grapes is such that the provision of casks, made in advance, has not been found sufficient, and part of the gathering had to be delayed until other casks could be procured."

THE WHEAT CROP OF FRANCE.

James O. Putnam, esq., consul at Havre, furnishes a circumstantial statement of the condition of the wheat crop in each of the eight distinct wheat-growing districts into which France is divided by the Imperial government. The crop of 1864, as estimated below, is held to be five per cent. less than a good average crop. That of 1863 was extraordinary, from which remained a large surplus unexpended in October of the present year. This is not only sufficient for consumption, but leaves a small quantity for export. The following is the estimated product for the present year:

	Hectolitres; or,	Bushels.
Northern district	28,500,000	80,940,000
Northeastern district	15,000,000	42,600,000
Southeastern district	11,500,000	32,660,000
Southern district	8,000,000	22,720,000
Middle district	7,000,000	19,880,000
Southwestern district	9,500,000	26,980,000
Western central district	10,000,000	28,400,000
District of the Landes	11,000,000	31,240,000
Total average crop	100,500,000	285,420,000

TURNIP-ROOTED CHERVIL.

Franklin Webster, esq., consul at Munich, Bavaria, transmitted, in September of 1864, a package of seeds of the *Chærophyllum bulbosum*, known there as the Cörbel-rube. It is found growing wild in Bavaria, but is said to have been first introduced from Liberia. Burnett thus alludes to it:

"*C. bulbosum* is said to be deleterious; but Haller affirms that the Kalmucs eat the roots with their fish, and commend them as a nutritive and agreeable food."

Mr. Webster says:

"The seeds should be sown the same year they mature, in October or November, or, according to some authorities, in August or the first of September, who assert that the plants grow in the fall, and under the snow in winter; but others deny that the seeds germinate before spring. They should be sown broadcast, two inches apart, upon a mellow but very rich soil, which, after the sowing, should be dressed one inch deep with thoroughly rotted horse manure. In May their scanty foliage is in full growth, which in June turns yellow and disappears, indicating that the roots are ripe and ready to be dug for the table. The roots consist of very numerous tubers, an inch, more or less, in length, and half an inch in thickness. After being a few days in the cellar they acquire a rich and most delicious flavor, like that of roasted chestnuts. The only method I know of cooking them is to boil them in salted water five or six minutes, or until a slight pressure of the finger will crack the skin off. Dip them in salt while eating them. To renew the seed, plant a few tubers in spring, or, better still, let a few remain over winter where they grew. They grow vigorously, attaining a height of six to ten feet, producing abundant seeds, which ripen in August. The seeds soon lose their vitality, and will seldom come up if left to sow a second year. They should be sown the same year of their growth. The great value of this vegetable, as an acquisition to an American gardener, is not only its deliciousness to the epicure, but the earliness of its maturity, fully supplying the place of potatoes, yet preceding them in time by a full month."

GRAPES AND OTHER PRODUCTS OF MALAGA.

A. M. Hancock, esq., consul at Malaga, communicates some interesting facts of the productions of that province, including grapes, almonds, figs, olives, lemons, oranges, wheat, barley, Indian corn, and, more recently, sugar-cane. Of the grapes, their principal source of revenue, there are fifty varieties, of which the Muscatel, Peroximen, Larga, and Loja are most highly esteemed. The Muscatel are grown on the hills near the sea, and back one or two leagues to the base of the mountains, which afford a shelter from the north and northwest. A continuous chain of hills, from one hundred to two hundred feet high, extending forty miles from Malaga to Nerja, is completely enveloped in Muscatel vines. Recently the Muscatel district has been extended, so that it now reaches a distance of seventy miles upon the coast. The soil is slate in various stages of decomposition, silex, and clay. The position is sheltered, a necessity with the Muscatel, which requires a southerly exposure, both for ripening the fruit and for ripening the raisins, a process requiring fifteen days of clear, fine weather in August. A good average crop is estimated at 1,500,000 arrobas, or boxes of 25 pounds.

The Peroximen produces the sweet Malaga wine and various dry wines, is a good table grape, and is grown extensively in the mountains between Malaga and Granada, which are more or less covered with vines. It is hardier than the Muscatel, and not affected by humidity, shade, or exposure. The mountain soil is of the same slaty nature, intermixed with minerals of different kinds.

The Larga is grown on the eastern coast, and, when dried, are known as the bloom raisins.

The Loja, or shipping, grows in the interior; the finest in the adjoining province of Almeria. This is almost the only vine that runs on trellises and trees. All other kinds are cut in December within a few inches of the ground, are planted in rows, at distances of six and eight feet each way; the weeds are carefully hoed out, and the vineyard kept clean. The vines are seldom manured except when old, and they live over thirty years. New vines are set in December; they flower in March and April, and ripen in July and August. In the last five years the vines have suffered from the oidium disease.

The following report is given of other products of Malaga:

"The almond tree flourishes best in stony, sterile soil, where no other tree could exist It flowers as early as December and January. The blossom is the most delicate of any known, and is injured by a sudden change of atmosphere or heavy easterly winds. This peculiarity causes the crop to be very precarious and short; but the value of its fruit compensates the farmer, making its culture preferable to that of other trees. The fruit ripens in July and August.

"The fig tree is less delicate than the almond, but requires more cultivation to preserve it. It adapts itself to all kinds of land, but the fruit is fairer and more luscious if reared in warm, sheltered positions, with but little moisture, which is prejudicial. Copious rains produce a short crop, of inferior quality, and cause an active fermentation and engender insects. The dry branches are pruned off, and also the suckers, which absorb the substance; and it is necessary to dig well around the tree once a year. The fig tree buds in March and ripens in July and August. There are some eighteen varieties.

"The olive tree grows everywhere, and the mountains abound with the wild olive. It blossoms in April, and the fruit is gathered in November and December. The neighboring provinces of Iden and Cordova are devoted to the culture of the olive, and the large supply of oil for exportation is chiefly received through those districts. Spanish oil would compete with the best Italian if more care were taken in extracting it by processes practiced in France and Italy.

"Lemons and oranges are abundant. They are planted in sheltered positions, not too near the sea. There are numerous plantations near the city of Malaga, on the banks of the Quadolmedina, which, properly speaking, is a mountain torrent, and many months of the year is perfectly dry; during the rainy seasons, however, large masses of water pass from the mountain to the sea, running through the city of Malaga, and the land along the banks is overflowed and becomes very fertile. The lemon trees blossom in March, and ripen in the summer, fall, and winter—there being three distinct species. The heavy exportation is in September and October, although the summer lemons are shipped as early as June and July."

Barley is raised on the vega of Malaga, and likewise in the valleys within the mountains. The wheat from the interior of this province is of the finest quality. Rye, oats, and grass, are scarcely grown. The horses and cattle are fed on barley, straw, corn-tops, and beans. Indian corn is raised to a considerable extent in this vicinity. The usual period for sowing wheat is about the middle of October, and harvesting in May and June. Indian corn planted in May and June ripens in September.

Cane sugar is produced about Malaga to some extent, and the culture of the cane is rapidly increasing. It is planted in April in loose, irrigated soil, and is cut in February and March. It is cut without renewal for from four to seven years. The product of refined sugar amounts to five or six millions of pounds annually.

The vega of Malaga is a plain, extending westerly two leagues. It is one league in breadth. A narrow arm of it reaches five or six leagues into the interior in one direction. The soil varies from the richest to the poorest, and is refreshed by frequent irrigation, rendering it very productive. To the evenness and mildness of the climate, quite as much as to fertility of soil, this region is indebted for its extraordinary productions. In every month of the year vegetables and flowers of every description can be produced in greater or less quantity without recourse to hot-houses, and without regard to fixed time of planting. The climate is remarkable for the dryness of the air, and the stimulating effects of the land wind from the north or northwest. Storms occur very seldom. The amount of rain in the last ten years has varied from twelve to thirty-seven inches per year; the best wine years having about twenty-four inches. In the summer months there is usually no rain; when much falls in August, as sometimes happens, the grapes are apt to burst open, and are difficult to dry. The following table indicates the condition of the atmosphere, and amount of rain falling for 1856, which was an average year, without frost through its entire duration:

Month.	THERMOMETER.			RAIN.
	Mean.	Extremes.		Inches.
January	58.6	64	56	9.18
February	57.01	65	53	1.40
March	60.9	67	57	3.05
April	64.5	68	58	1.37
May	67.6	77	66	0.05
June	76.6	81	92	0.17
July	79.9	84	78	....
August	79.9	85	78	....
September	76.9	80	74	4.86
October	71.6	78	63	0.19
November	64.9	68	50	0.77
December	59.1	63	55	2.25
Year	68.1	85	50	22.79

The consul gives a further exhibit of the flora of this interesting region, for which there is not space in this article.

EXPORTS FROM BRINDISI, ITALY.

J. S. Redfield, esq., consul at Brindisi, Italy, gives a statement of the products of that province, consisting mainly of cotton, olive oil, wine, figs, linseed, &c., showing a ten-fold increase in cotton culture, though the quantity pro-

duced is yet small. An increase in the prices of oil and wine is indicated. The average exports of these products are as follows:

Olive oil, tuns	25,000
Wine, tuns	15,000
Cotton, lbs	15,000,000
Dry figs, lbs	10,125,000
Linseed, quarters	8,000

PRODUCTS OF THE IONIAN ISLES.

Amos S. York, esq., consul at Zante, reports the currant crop of the islands of Zante and Cephalonia. At Cephalonia they were mostly destroyed by rain. The two islands produced about thirty million pounds. The Zante crop, from its superior quality, brings the highest price, and is sold at $25 to $26 per thousand pounds; the crop of Cephalonia at about $20.

Zante also produces olive oil to the amount of 640,000 gallons; the island of Corfu 6,400,000 gallons. The price during 1864 was $10 per barrel of sixteen gallons. The price of wine ranged from $3 to $6 per barrel.

COCHINEAL IN TENERIFFE.

W. H. Dabney, esq., consul at the Canary Islands, writes from Teneriffe respecting the product of cochineal.

This is a singular *crop*, being an insect, and not a vegetable, the *Coccus cacti*, found principally on a particular species of the cactus, the *Cactus cochinellifer*. The plant is cultivated extensively for the express purpose of obtaining the insect, which is used as a dye in Mexico, Honduras, Teneriffe, Java, and other places. The insects are scraped from the plants into bags, killed in hot ovens or in boiling water, then dried in the sun, and placed in skin-bags for exportation. The dried insect somewhat resembles a full-sized grain of barley. The dye is a beautiful crimson. The following is the statement of the consul:

"The principal production of the Canary Islands at present is the cochineal, which, although introduced into cultivation but a short time since, comparatively speaking, has assumed quite large proportions, the crop of 1861, the largest on record, having reached 2,244,007 pounds, of the value of $1,212,877, from Teneriffe alone. The crop of 1863 was small, owing to the excessive heat, which destroyed it, and was 776,605 pounds, of the value of $582,500. The same cause, combined with difficulty of obtaining the seed, will make the crop of 1864, now coming in, also a small one. In the absence of data we may estimate it at least equal to that of 1863 in quantity, and probably it is greater."

The consul also refers to the grape crop, which has been almost annihilated by the oidium. It has somewhat recovered from that disaster, and now produces from 2,000 to 3,000 pipes of wine. Fruit, garden vegetables, and cereals, including Indian corn, are grown successfully, and their yield has this year been abundant.

TRADE OF TRIPOLI.

The following statement of imports and exports for 1864, from William Porter, esq., United States consul at Tripoli, will show the prominent productions of that portion of northern Africa, and the surplus of each:

Imports.		Exports.	
British manufactures	$87,000	Ivory	$85,000
Foreign manufactures	22,500	Dates	5,000
Colonial	42,500	Natrum	20,000
Iron	13,500	Madder	39,000
Lead	5,000	Butter	49,000
Brass	8,850	Wheat	100,000
Spirits and wine	22,500	Barley	90,000
Tobacco	30,000	Oil	102,000
Rice	14,000	Ostrich feathers	50,000
Timber	14,500	Salt	20,000
Earthenware	5,000	Other articles	47,000
Other articles	17,500		
			607,000
	282,850		

COTTON IN MOROCCO.

Jesse H. McMath, esq., consul at Tangier, Morocco, says that the Sultan, in 1863, encouraged the cultivation of cotton; that American and Egyptian cotton-seed was imported from England, and large tracts of crown lands were planted, and quite a number of the more enlightened Moors engaged in the cultivation of the staple on their own account. The quantity grown could not be stated, but enough was known to justify the statement that cotton can be successfully cultivated there. The consul says "two hundred quintals were shipped from the port of Mazagan, and one hundred from the port of Saffi, to England during the last quarter. It is claimed here to be equal in quality to American cotton. This I doubt. With proper encouragement its cultivation would greatly benefit this people, but, from some cause altogether unaccountable upon any reasonable hypothesis, the Sultan has within the past two months prohibited the cultivation by private enterprise. The edict will materially affect a number of Europeans residing in this country. Preparation was made by them to engage in the cultivation of this much-needed staple at the time the Sultan's edict was proclaimed; but in view of it they have to abandon the enterprise, for they cannot claim from the Sultan any privilege not secured by treaty, which he denies his own subjects."

PLEURO-PNEUMONIA.

Charles H. Upton, esq., consul at Geneva, reports the prevalence of pleuro-pneumonia among the herds of Upper Savoy, and transmits a decree of the Council of State, made at the instance of the Department of the Interior, prohibiting utterly the introduction of bovine animals of any description, even with a certificate of regular health, from the infected commune, and the hides of such animals share in the interdiction. Every inspector of cattle, country police, gendarme, and agent of police, is required to seize and impound every animal from that district, and violations of this decree are punishable by fine of two hundred pounds and five days' imprisonment.

The precautions taken in Europe against the spread of this contagion are exceedingly strict and broad, and a lively sense of the danger and possible destruction of property is constantly felt.

GRAPE-VINES FROM JAPAN.

Hon. Robert H. Pruyn, minister resident at Kanagawa, Japan, sent to this department in January, 1864, specimens of grape cuttings, bulbs of lilies, and other plants. The bulbs arrived in a state of decay beyond recovery; the evergreens were dead, with one or two exceptions; deciduous plants were in a fair state of preservation, and the grape-vines arrived in perfect condition.

STATISTICAL REPORT UPON WOOL AND WOOLLEN MILLS.

[STATISTICS COLLECTED BY THE DEPARTMENT.]

SIR: The farmer, as a rule, loses sight of his wool from the moment it leaves his door till the day of its return as cloth for his wearing. Its intermediate history is a blank. It would be well if he knew the processes it undergoes, the damages it may sustain, and the conditions under which its highest values are educed at the least expense. He would find that his own management, from dropping to shearing and putting up the fleece, has much to do with success or failure in the manufacture. And the manufacturer, as a class, is almost equally as ignorant of the principles and practice of sheep-husbandry. He knows wool, not by breeds, but by the multiform classification of the wool-sorter. Nor is this very strange, as breeds, especially in this country, are so mixed that the most eminent breeders of acknowledged pure-bred sheep quarrel not a little about the pedigree of their flocks.

It would be well for both classes if they would give a little attention to the respective industries of which they know so little. A better understanding of the necessities and difficulties of each would lead to greater harmony of views and action. It would be seen that their interests are identical. United, wool-growing and wool-manufacturing must stand; divided, they will fall. Nothing is shown more fully than this in their past history. Tariffs for the protection of the manufacturer have been enacted, and mills have arisen and flourished; and at the same time the farmer has made satisfactory sales of wool, and has proceeded to increase his flocks. Just then radical changes in the tariff have thrown wide open the door to foreign wool, and especially foreign cloth, and manufacturers have failed, and farmers, disgusted, have slaughtered their flocks for the hide and tallow. This has been the history of sheep and wool ever since the origin of this government.

While their general interests are identical, and the prosperity of the one is in a series of years accompanied surely by the success of the other, there are points in which advantages, on one side or the other, may be enjoyed. A knowledge, by both parties, of all the relations of wool production and consumption, as well as of government protection to both interests, is essential to mutual harmony in feeling and justice in action. And a willingness to deal fairly, however contrary to the instincts of selfishness, which is ever looking for a temporary advantage, should be the policy and practice of each party. The farmers will scan closely, and possibly with some jealousy, the powerful combinations of the manufacturers; but it is to be hoped that such jealousies, if felt, may prove groundless.

In harmony with this theory circulars were issued, at the close of the year 1864, from this department, designed to elicit some of the facts of wool manufacture. The returns were as prompt and as general as might be expected, though not as complete as could be desired. They show a prosperity that has never before been equalled in this country. They prove that the business has doubled in five years, with few indications of decline. On the contrary, improvement of machinery, enlargement of mills, and the building of new ones, are everywhere reported.

FINE WOOL.

There is some diversity in the opinions of manufacturers relative to the kind of wool most needed in increased quantities. There are a few, who make fine cassimeres, who desire a finer quality than that produced by the Vermont

merinoes. A Vermont manufacturer, who is in this category, says he obtains his wool in Pennsylvania. It may be generally known, as it is to wool dealers, that Washington county, in western Pennsylvania, and some portions of West Virginia and Ohio, have Saxony flocks, or those with heavy strains of that blood, that are superior for fineness of wool to sheep of any other portion of the States. A Connecticut manufacturer says: "We shall have to give up making fine goods, as the quantity of American strictly fine wool grown is decreasing yearly." Another, in New Hampshire, says he needs "fine fleece to take the place of Cape, as a high tariff and the gold market prevent importation." One in Maryland, where mutton varieties prove to be most profitable, complains that he finds difficulty in getting wool of the quality suitable for the goods required. It is certain that there will always be a market for fine wool; and that while a few require fibres of superior delicacy, the wool of the American merinoes, of medium fineness, will be found fine enough for a large proportion of the cassimeres and similar goods. The testimony of mill-owners is very uniform upon this point.

A Massachusetts manufacturer presents the following plea for the introduction of very fine wools, and also worsted wools at low rates of duty: "The question 'what wools American manufacturers require' is very little understood by the country at large, or the wool-growers. In the early history of the manufacturers of the country broadcloths were made extensively, and while we kept pace with the machinery of Europeans, they, by the introduction of their colonial short-staple wools, such as Cape and Australian, were able to drive us all out of the market by their superior face finish, so that the whole business was abandoned by us, and other descriptions of woollens substituted, requiring a less degree of finish, such as satinets, fancy cassimeres, flannels, &c. Since the introduction of these short-staple wools the broadcloth department is beginning to revive; and while we consume largely of American wool for warp, by the use of the short staples for filling we are gaining ground and preference with the consumer. If 'half a loaf is better than no bread,' then all the increased value of American manufactures over the raw material imported is so much increased wealth to the nation. The woollen interests are capable of great diversity, and but few branches are as yet introduced into this country; and if our wool-growers could be divested of the idea that the American wools are suitable for all purposes, and feel, to advance their own interests and the consumption of American wools, that the American manufacturer should have access to all grades of wool, with which to compete with the Old World in the successful production of wool fabrics, then we could go on, hand in hand, each in his own capacity, adding to each other's success and the nation's wealth. Our adversity and our success have always proved theirs. The Boston prices current for the past twenty-five years will show this fact, and will, more conclusively than any other fact, prove that our ability to get and use foreign wools in conjunction with American wools has always advanced the price of American wools. We want large quantities of American wools, but must have a supply of the desired kinds of foreign wools, or else confine manufacturing to a very narrow scope, and purchase millions upon millions of various styles of woollens and worsteds abroad. A large amount of worsted wools are consumed here of foreign growth, and so far as they are not, or cannot, be produced here, it is better to increase the value of raw wool from abroad with our skill and labor, sustained by our food, than to send abroad our money for the carpets, blankets, and worsted stuffs, the productions of other countries."

No doubt exists of the necessity of greater supplies of the two kinds of wool especially referred to—very fine wool and worsted wool. But it should be grown by our own farmers. It would be very erroneous to assume that such wools cannot be produced here. It is very true that climate affects the fibre of wool; it is also true that the United States includes in its wide extent almost all climates, from Maine to California, and from the summit of the Alleghanies

to tide-water. The fact exists that wool of superior fineness is produced on the western slope of the Alleghanies to some extent, and can be increased; the only question relative to it is, will it be equally profitable with that of the coarser merinoes, or of the long-wool breeds? With regard to worsted wools, there can be no question. It is little less than disgraceful to American sheep husbandry that a necessity exists for importing a single ounce of combing wools. The mild, moist climate of England may be superior to this country for the production of lustrous wools, yet there are localities here which may yield a product rivalling that of the Romney Marsh and Lincolnshire lustres. Not only *can* we grow combing wools, but we shall; the movement is already in progress, and will be continued till we export the long and middle wools—unless our manufacturers choose to supply in good part the markets of the world with worsteds.

The only wool that should ever be imported hereafter is a low grade, as carpet wool, too low in price to be the product of an improved condition of agriculture.

TOO MUCH OIL.

On one thing manufacturers are unanimous—the loss resulting from the excessive breeding to grease, which threatens to react upon farmers, although the practice originated very properly in self-defence against the injustice of paying nearly uniform prices for all grades of wool. Local agents, with instructions to buy wool the average quality of which the principals very well knew, at a very advantageous average price, cared only to get their commission of one cent per pound upon the largest quantity of wool at the least trouble. And in order to obtain large lots of well-posted farmers, they exceed their instructions a little, and make up the loss by paying less for small lots of better wool. Farmer number one would find, for instance, while his twenty fleeces had been sold for seventy cents, that his next neighbor had obtained seventy-five for his two hundred imperfectly washed and inferior fleeces. Is that man to blame for selling as much grease or dirt the next year as the wool-buyer will take? The manufacturer pays wool prices for this dirt, the buyer gets a cent per pound on it, the railroads take as much more for transporting it, and additional expense is incurred of labor, machinery and chemicals in getting it out, and then it is washed away in the river—an utter waste, not even utilized for the fertilization of the soil.

A New Jersey manufacturer acknowledges that "as long as wool is bought as it has been for the last few years, farmers will continue to raise greasy wool, as they are getting within two or three cents as much for it as those that raise the light wool. So that the fault is with the manufacturer instead of the farmer." Another: "Farmers in this section generally seem anxious to breed from the heaviest and most oily-woolled bucks, which tends to increase the weight of the fleece, and at the same time to diminish the actual amount of wool. The day must soon come when manufacturers must refuse to buy such wool, except at such a discount as would render it more profitable for the farmer to produce a lighter and longer staple." One who has had forty years' experience in the wool manufacture says he has worked imported Spanish wool, but never has "found any wool of the same style that shrank as much as the Atwood wool," while "the pure French merino wool is fine, with long staple, the fleeces are good size, and are not so objectionable on account of shrinkage." Yet the manufacturers buy oily wool, and can scarcely do without it, using it for a great variety of purposes, even for combing. They know very well that foreign wools shrink even more than our grade merino, and almost as much as that of our highly improved, heaviest, oiliest rams. Their hardiness, improved form, and large proportion of wool to weight make the American merino the most useful and profitable breed of fine-wool sheep in the world. While holding this opinion decidedly, it is but proper to suggest that damage may result to this valuable race by continued breeding to grease.

MIDDLE STATES WOOL.

The superiority of the climate and grasses of the middle or central States of the United States for the production of wool is supported by the evidence of wool sorters and manufacturers. Colonel Randall long since called attention to the superior quality of the wool of Virginia. Western Pennsylvania and Ohio wool is celebrated for evenness, length, and strength of fibre. A New York manufacturer claims that "the most profitable wool for the manufacturer is the light medium fleece of Ohio and West Virginia; it commands a good price always, and is eagerly sought for." Another says: "The wool grown in the middle States of the country is equal to any grown in any portion of the world. The staple is sounder and stronger than the wool from hot climates, which is dry, harsh, and tender—not making nice goods. The Middle States wool is mostly medium in fineness, excelling in condition and strength of fibre." This is well illustrated in California. The long and severe drought and arid atmosphere of the summer render the wool harsh and dry, while the mild climate and moist atmosphere of winter produce a much better quality of wool. This climatic peculiarity makes it necessary to shear twice a year. If but one clip is made two qualities of wool are worked together, with an effect like that of putting new cloth into an old garment. A deterioration is produced likewise by colds and other diseases produced by exposure to sudden changes of the weather and to severe cold. These difficulties are avoided in the mild climate of Ohio and Virginia, which, with abundant and nutritious food, conduces to perfect health and vigorous growth of flesh and wool.

COMBING WOOL.

Another fact suggested by manufacturers, and urged more generally and strongly, perhaps, than any other, is the increased demand for combing wools. A firm in Vermont, who are wool-growers as well as manufacturers, using themselves as much of fine wool as of middle wool, says: "Soon, we think, the northern and middle States will see their interest in raising mutton sheep, and this will give us the combing wools." Another says, writing of the kinds of wool desired: "Worsteds, in particular, will soon be introduced upon a large scale, and there should also be more attention given to this class of wools." A Connecticut manufacturer, engaged upon fine wools, as most of the mill proprietors of that State now are, thinks that "more attention should be given to carpet and delaine wool."

It is difficult to obtain this class of wool, Canada being the main reliance. But wools from across the border are paid for in gold—a fact which has militated against a supply from that quarter. As a substitute for worsted wools proper, the strong, long, sound fibre of Ohio, one-fourth to one-half merino, has been accepted. Even those who make cassimeres of medium fineness, and prefer full-blood American merino, are in the habit of buying this medium wool, which will shrink but twenty-five to thirty-three per cent. in cleansing, and mixing it with the finest, which shrinks from fifty to seventy per cent.; "and with the present process of finishing it will pay better than any fine wool." It is added, "One reason why coarse wool brings as much as fine is because it will make more cloth, and the trade will not pay enough more for very fine to make the difference."

Most of the combing wools used come from Canada—Leicester, Cotswold, Southdown, and their crosses. They shrink only from eighteen to twenty-five per cent., and produce twice as much cloth, in proportion to weight of fleece, as our heaviest fine-wool fleeces. Hence they are profitable to the cloth-maker at a high cost. A large proportion of these sheep are kept in the mild and fertile area north of Lake Erie, lying directly between New York and Michigan. The success of coarse wool-growing here, in the lake region and valley of the St. Lawrence, is proof of their adaptation to the northern portion of the United

States. Such evidence is rendered unnecessary, however, by the proverbial health and vigor of these breeds, in isolated flocks, in Ohio, the middle and eastern States. An extract from the *Montreal Gazette* presents the profit in working this class of wools in a very strong light, in an article on "Scotch Tweeds:"

"The Canadian manufacturers have been successful in bringing out a class of goods so much superior to the imported article, both as regards pattern and fabric, that if the present demand for them on this side were not greater than can be supplied, we are assured they could be exported and sold at paying prices in the leading British markets. The superiority of the Canadian fabric, too, is so striking that it commands precedence over the Scotch manufactures in the markets of New York, Boston, and Philadelphia, and is exported and sold there with a profit, after paying the United States duty of about 50 or 60 per cent., made up in part of specific and ad valorem duties. If any reader is incredulous at this broad statement of facts, so different from the popular apprehension, as we were ourselves at first, we can assure him it can be established in the most simple and positive way, and that there is no room for any doubt. It is a fact that the largest house in this trade in New York did, a short time since, contract for all the tweeds of the description we have referred to that can be turned out of three of the principal Canadian mills till October next. Some of the mills turn out 160 pieces a week; and the money involved is not less than $8,000 to $10,000 per week. This contract affords a profit, and the goods pay, as we have said, from 50 to 60 per cent. duty to enter the United States. While these goods are cheaper than the same kind of goods imported from Scotland, their real value is greater from their manifestly superior quality—from what reason arising we do not know; but the fact is sufficiently palpable from a comparison of a piece of the best "Bannockburn" with a piece of the same kind made at Almonte."

WORSTED BRAIDS.

An important branch of the worsted manufacture, recently introduced into this country, will illustrate the facility with which the working of combing wool in its various forms of fabric has been extended in the past few years. A single establishment in New England produces $400,000 worth of worsted braids annually. These braids, which are used for the binding and trimming of ladies' dresses, may not equal the French article, but they are pretty and substantial, worthy to decorate the dresses of the most patriotic and distinguished of the wives and daughters of America. Several mills of this kind are in operation. One manufacturer, in Rhode Island, writes that he uses for these goods number thirty-two woollen yarn, some of it imported, some American, made from wool of fine long staple. A Massachusetts manufacturer has given, at the request of the Commissioner of Agriculture, a statement of this new industry somewhat in detail, as follows:

"ATTLEBORO', MASS., *November* 19, 1864.

"DEAR SIR: In answer to your favor of October 20, I would say that I am engaged in the manufacture of worsted braids of all descriptions. I purchase the yarn, which is American spun, and made from Leicester wool raised exclusively in Canada. The manufacture of these braids is wholly a new business in this country, and the consumption of material amounts annually to more than three millions of dollars. I commenced the business about two years ago, and imported the yarn from England the first year, but subsequently induced a few American manufacturers to import machinery for manufacturing worsted yarns, and they are now competing successfully in quality with English or German yarns. At first they used the wool "hand-combed," but now they use English power combers, which do the work at one-fourth the cost, and better in quality.

"Our American spinners go to Canada for all their combing wool, *and pay for it in specie;* and I think I am correct in stating that there is none raised of that description in the States.

"I am told by western wool-growers that they would prefer to raise the Leicestershire sheep, on account of the large and heavy fleece they furnish, and that the climate in many of the States is favorable to that class of sheep.

"A large and increasing demand has sprung up within two years for combing wool, and a necessity exists that our wool-growers should understand this fact. It is not only an in-

creasing demand, but a permanent one. which goes to make up the toilet of every lady in the land.

"I am acquainted with manufacturers in Massachusetts who have started the manufacture of worsted yarns within one year, mostly with imported machinery, and consume combing wool to the amount of three millions of pounds this year. This business is now in its infancy, and with proper encouragement will become an important branch of manufactures in this country. The question to-day among these manufacturers is, "Where is the wool to be obtained from for the balance of the year?" This wool costs to-day in market $1 26 per pound, while the best fleece of New York and Michigan can be bought at 90 cents to $1 per pound. I am very glad you are investigating this subject, and I think you will be surprised when you ascertain how extensive the demand is and will be for this class of wool; and yet our wool-growers are ignorant of the fact.

* * * * * * * * *

"Very respectfully yours,

"H. N. DAGGETT.

"Hon. ISAAC NEWTON."

Specimens of American braids may be examined at the museum of the Department of Agriculture.

PUTTING UP WOOL.

While manufacturers are unanimous and urgent in their recommendation of greater care in putting up wool for the market, it is gratifying to obtain from them an acknowledgment of improvement in the practice of farmers in this regard. A mill-owner in Ohio says: "The grade of wool has much improved in the last four years, as well as the manner of handling it." "Our farmers," he adds, "are paying a good deal of attention to wool-growing, and towards improving their flocks, and we feel flattered to think that southern Ohio will in a few years be as noted for its wool crop as is Vermont." Yet the complaint of defective washing, excessive amount of twine, packing unwashed tags or dead pulled wool, and other forms of deterioration, is very general. Some, it is urged, wash slightly, and delay shearing for several days, till, with added dirt and grease, it is nearly as dirty as before. Much complaint of imperfect washing is made. An Ohio manufacturer refers to a case which, if not hypothetical, is an extreme one, it is to be hoped: "One man, in addition to driving through the canal, *sent his hands in with poles to stir up the mud.*" A rejection of wool in such objectionable conditions is threatened, or a reduction in price to more than meet the loss. This is really an evil worth pondering. This loss in weight, by yolk, dirt, filthy tag locks, seeds, burrs, sticks, straw, and excess of strings for tying, is not the only objection to dirty wool. If a deduction is made of all that will not make cloth, the remainder will not represent equally, in different fleeces, the value of the wool. If the cost of troublesome processes of cleaning be added, there will still be left an advantage to clean wool. The fibre is torn and injured by the separation of burrs, straw, &c., which are so difficult of eradication, and minute broken particles are still scattered through the cloth, showing more conspicuously after dyeing, from the difference between animal and vegetable substances in taking dyes. The fibres of wool are semi-transparent tubes, into which the coloring matter enters. If the harls are unbroken, a bright, glossy color is received very evenly; if broken, the color is dull and irregular. There is also a want of uniformity in fulling when the fibre is broken.

The first process in the manufacture is the sorting, which includes dividing into grades, picking out the straw and other foreign matter; then it is scoured, separating most of the natural oil and remaining dirt; afterwards the picker loosens and opens the fibres, and takes out many seeds and some remaining straw, and the cards, operating with a burring machine, divest the fibre of closely clinging foreign matters, which otherwise would crush the expensive card teeth and injure the cloth. Nor is this the end of the trouble. Broken straw passes the cards, though most of it falls out beneath the machines, and, in the spinning machine or mule, breaks the threads, becomes woven into cloth, and is sought and laboriously pulled out with nippers, leaving little breaks and cavities in the fabric. The farmer, no

more than the merchant or mechanic, is willing to accept such cloth, unless with a reduction in price. It is proper that this should be fully understood, that wool-growers may demand and receive a fair compensation for *clean wool*, when manufacturers shall discriminate more closely against dirty wool. As yet, they have never paid enough for wool in extra condition, compared with the prices paid for that which has been badly put up. And it should be remembered that if wool dealers can afford to pay fifty dollars for one hundred pounds of wool which only makes thirty pounds when clean, they can make a profit in paying double that sum, or one hundred dollars, for one hundred pounds which will leave eighty after cleaning. This is but double the money for almost three times as much wool. So if buyers seek to depress the price of badly conditioned wool, farmers should see that they *raise* the price of very clean wool. If they have hitherto bought dirty wool at certain prices, they can well afford to pay proportionally higher prices for improved cleanliness, which is now the acknowledged tendency of wool-growing practice.

This damage, resulting from dirt and careless handling, accounts for the low price of South American and South Russian wools, quite as much as their inferior quality, which is the result of an arid climate. Seven, eight, and ten cents were common prices years ago, and during the war the average prices have been less than seventeen cents. This illustrates the advantage possessed by our wool-growers—an advantage that should eventually give them the command of the markets of the world for the better qualities of wool. As in cotton so in wool, our climate and character of labor will enable us to excel all other lands, both in quality and quantity. And the same rule holds with wool as with butter or fruit, that the greater the care in handling, and the better the condition in market, the greater the profit of production; or if it does not *now*, it certainly will in the long run.

PROTECTION.

Some of the manufacturers incidentally refer to the subject of protection against foreign wools and woollens. The subject is highly important, and legitimate for discussion in these reports, but is not embraced in the present design. It is believed that more enlightened views are beginning to prevail upon the subject. Immense loss has hitherto been entailed, both upon farmers and manufacturers, arising from the want of a well-regulated and settled tariff policy, looking to the future prospects and permanent interests of the country. The necessity for revenue has assured the continuance of high duties upon foreign goods. The only question, therefore, for present consideration is, Whether the scale of duties upon the different classes of wools and kinds of fabrics is equal and just to the two great classes interested? While protection is a policy that is settled for the present as a necessity and a fixed fact, there is a class yet clamoring factiously against it, exciting discontent, and especially seeking to embitter the farmer against the manufacturers—the west against the east. Such persons should be indignantly frowned upon as the farmers' enemies and the enemies of their country. Even efforts have been made tending to discourage woollen manufactures as unprofitable in States like Pennsylvania unless they can be "protected" against the superior facilities of the older manufacturing States—a suggestion insulting to manufacturers and operatives, whose ability to initiate and develop successful progress in industrial art is thus decried.

Of course there is a variety of opinions expressed by different manufacturers relative to protection in letters to the department. Some selfishly favor protection to themselves by a tariff on woollen goods and the admission of wools duty free. Another, in his liberality, deems it proper "to gradually increase the duty on wool as soon as it can be done without checking the production of the woollen mills, and after a few years (as soon as the farmers can increase the stock of sheep sufficiently) the duties should be so increased as to give the raising of nearly all the wool to our own farmers; and then they will have the benefit of furnishing the vast amount of other farm produce consumed by the

population employed in the manufacture of wool. Thus a high duty on foreign wool and our woollen goods imported will operate for the mutual benefit of the farmers and manufacturers, and the prosperity of those two classes of the population will give an impulse to the mercantile and other interests of the country generally."

STATISTICS.

It would be more gratifying and valuable as an exhibit of our wool consumption if the manufacturers had *all* responded to the few inquiries made in the circular of the department. The total number of factories using wool in any shape, as reported by the assessors of internal revenue, was 1,704. Returns were received from 770 who work raw wool, and informally from many more who only use wool at second hand, as yarns, hat felting, &c. Still there are many wool-consuming factories unreported, probably reaching at least one-fourth of the consumption.

The following table includes these incomplete returns, as compared with those of the last census:

States.	1859–'60.		1864, (partial.)	
	No. of mills.	No. of pounds of wool consumed.	No. of mills.	No. of pounds of wool consumed.
Maine	61	2,646,200	22	4,790,500
New Hampshire	71	3,596,730	44	9,474,000
Vermont	50	3,303,500	25	4,395,000
Massachusetts	131	26,271,200	154	41,655,000
Rhode Island	50	5,000,000	41	9,595,000
Connecticut	90	8,000,000	58	11,844,500
New York	235	11,708,230	129	17,936,000
New Jersey	35	1,712,000	12	2,601,000
Pennsylvania	447	6,223,850	131	12,690,000
Delaware	6	147,500	4	275,000
Maryland	25	955,800	8	168,000
Ohio	113	1,054,540	41	1,099,000
Indiana	84	1,009,000	38	1,406,000
Illinois	33	545,000	13	437,000
Michigan	20	223,100	15	425,000
Wisconsin	15	222,400	9	190,000
Minnesota	......	....	3	190,000
Iowa	23	265,200	15	435,000
Missouri	99	856,244	5	287,000
Kentucky	92	1,310,700	2	275,000
Oregon	1	150,000	1	350,000
Total	1,681	75,201,194	770	120,498,000

The remaining States consumed in 1859 as follows: Southern States, 4,795,378 pounds; California, 400,000 pounds. At the present time but little manufacturing is done in the southern States.

The mistake should not be made of contrasting the *number* of mills in 1859–'60 with the number reported for 1864. The former includes all kinds of mills; the latter only those using *raw wool*. The number reported by the assessors shows an increase.

A majority of these establishments represent separately a small amount of wool. Those in country villages and in the western States do custom work mainly, making yarn or rolls for local domestic use, and coarse cloth on shares or in exchange for wool. Fifty-seven represent about one-third of the entire consumption, not one of which uses less than half a million of pounds yearly,

and a few require three millions each. There are many other heavy companies, using from one hundred thousand to five hundred thousand pounds. A list of the large mills is appended:

List of large mills.

Proprietors.	Location.	Pounds of wool used.	Pounds of domestic wool.
Dexter Mills	Dexter, Maine	500,000	100,000
Robinson Manufacturing Co	Oxford, Maine	700,000	466,000
North Vassalborough Manuf'g Co.	N. Vassalborough, Maine	1,000,000	....
Manchester Print Works	Manchester, N. H	2,000,000	2,000,000
Belknap Mills	Laconia, N. H	500,000	166,000
F. C. Kennedy	Winooski, Vt	1,500,000	....
Ætna Mills	Watertown, Mass	589,000	262,000
Belvidere Woollen Manuf'g Co	Lowell, Mass	500,000	500,000
G. H. Gilbert & Co	Ware, Mass	600,000	600,000
J. Z. Goodrich & Co	Glendale, Mass	500,000	....
L. Pomeroy & Sons	Pittsfield, Mass	750,000	250,000
Adriatic Mills	Worcester, Mass	600,000	450,000
S. Blackinton & Son	Blackinton, Mass	500,000	500,000
Evans, Seagrave & Co	Blackstone, Mass	1,200,000	1,200,000
P. Anderson	Lowell, Mass	800,000	....
Berkshire Woollen Co	Great Barrington, Mass	500,000	500,000
J. W. & H. A. Hall	Boston, Mass	540,000	540,000
Hamilton Woollen Co	Globe Village, Mass	1,600,000	1,600,000
Thomas Barrows	Dedham, Mass	500,000	250,000
Clappville Mills	Clappville, Mass	500,000	500,000
Edward S. Hare & Co	Millville, Mass	750,000	450,000
Pacific Mills	Lawrence, Mass	3,000,000	3,000,000
Messinger & Wright	Worcester, Mass	500,000	375,000
Merchant's Woollen Co	Dedham, Mass	1,000,000	800,000
Bigelow Carpet Co	Clinton, Mass	1,000,000	....
Saxonville Mills	Boston, Mass	1,500,000	100,000
Evans, Seagrave & Co	Providence, R. I	700,000	700,000
T. R. Hyde & Co	Carolina Mills, R. I	600,000	....
Pooke & Steere	Greenville, R. I	620,000	620,000
Taft, Weeden & Co	Providence, R. I	800,000	700,000
L. Reynolds	Mohegan, R. I	700,000	350,000
Atlantic Delaine Co	Providence, R. I	750,000	500,000
East Windsor Woollen Co	Warehouse Point, Conn.	600,000	30,000
Whittal, Le Fevre & Co	Waterbury, Conn	500,000	250,000
Lounsbury, Bissell & Co	Winnipauk, Conn	700,000	100,000
Union Manufacturing Co	Norwalk, Conn	1,000,000	....
American Mills	Rockville, Conn	540,000	360,000
Rock Manufacturing Co	......do	670,000	270,000
E. S. Higgins & Co	New York, N. Y	1,000,000	....
A. Middleton	Utica, N. Y	600,000	400,000
James Roy & Co	West Troy, N. Y	800,000	800,000
Troy Woollen Co	Troy, N. Y	500,000	500,000
William G. Wise	Auburn, N. Y	500,000	250,000
Peter Clogher, agent	Utica, N. Y	652,000	152,000
C. H. & F. H. Stoll	Hudson, N. Y	600,000	600,000
Stitt & Underhill	New York, N. Y	782,000	521,000
Stephen Sanford	Amsterdam, N. Y	650,000	....
John T. Waring & Co	Yonkers, N. Y	3,000,000	1,000,000
Camden Woollen Co	Camden, N. J	600,000	600,000
Benj. Bullock's Sons	Conshohocken, Pa	675,000	675,000
Thomas Dolan	Philadelphia, Pa	500,000	500,000
Joseph B. Hughes	......do	1,500,000	750,000
Milne Brothers	......do	550,000	550,000
Samuel W. Cattell	......do	600,000	600,000
Tremont Woollen Manuf'g Co	Frankford, Pa	752,000	178,000
B. Winpenny	Manayunk, Pa	500,000	375,000
Samuel Bancroft	Media, Pa	1,612,000	1,612,000
Total		48,183,000	28,552,000

The result of a fair examination of all these statistics, together with other data bearing on the subject, is the conclusion that our woollen manufacture has increased, during the war, from a consumption of eighty millions of pounds to one hundred and sixty millions. A study of all the circumstances which environ the business will convince any reasonable man that the product of these manufactures will increase, in future years, with increase of population and introduction of new branches of manufacture, rather than diminish. And in this calculation the temporary scarcity of cotton has not been considered.

REPORT OF THE CHEMIST.

SIR: I have the honor to submit the following remarks relative to the operations conducted in the laboratory of this department during a portion of the past year.

My attention having been called to the increasing demand for the diffusion of a knowledge of fermentation, its causes, different stages, kinds, &c., I have occupied the time not otherwise employed in a somewhat extended series of experiments upon it, and will preface the account of miscellaneous analyses with some notice of this subject, so interesting to all generally, and in a business way to brewers and vine-growers.

Fermentation is generally understood to be that process by which liquids containing sugar in solution, like the juices of ripe fruits, are decomposed into alcoholic products such as wine or cider. In a chemical sense, however, we have to admit of several other kinds of fermentation besides the vinous, to which the terms *viscous*, *acetic*, *lactic*, and *butyric* have been respectively applied.

The active body which by its presence causes the decomposition of sugar is called *ferment*. Liebig considers the ferment (always containing nitrogen, and belonging to the class of albuminous principles) to be in a state of self-decomposition, its molecules in motion; and that that impulse is communicated to the sugar particles themselves, thereby breaking them up into more simple and permanent forms, such as alcohol, carbonic acid, &c. This savant applies his ingenious theory to explain the effect of certain blood poisons, such as miasmata, small-pox virus, sausage poison, &c., which he thinks act upon the vital fluid as ferments. Many chemists at the present day seek for the cause of this metamorphosis of sugar in the unquestionable organic structure of the ferment, *i. e.*, its vitality. Thus the common beer yeast consists of minute vesicles or cells, each of which constitutes a living vegetable organism, taking rank botanically among the lowest class of fungi.

There seems to be abundant experimental proof that the various kinds of fermentation are due to specifically different organisms.

ALCOHOLIC OR VINOUS FERMENTATION.

The expressed juices of grapes, apples, pears, cherries, currants, &c., &c., always contain, besides a certain amount of grape or fruit sugars,* more or less

* Cane and milk sugar may undergo the same decomposition under the influence of ferment, but only after being first converted into fruit sugar; as is proved by the inversion of the rotary powers from the right to the left.

of a nitrogenous or albuminous substance which gives rise to spontaneous fermentation, provided a limited access of atmospheric air and a proper temperature are granted. In a vacuum and at or below 0° C., (equal to 32° Fahr.,) no such change will take place. If grape must is exposed to the air at a temperature of from 10° to 21° C., (equal to from 50° to 70° Fahr.,) it soon becomes turbid and an evolution of carbonic acid gas takes place. The mass is now perceived to be in lively motion; particles of the ferment, loading themselves with the liberated gas-bubbles, become specifically lighter, and rising to the surface discharge the gas and then sink again. This continues until all the sugar is decomposed, and in its place we find alcohol and some products of minor importance, such as glycerine and succinic acid, together with traces of undetermined matter. According to Pasteur the following analytical results have been obtained:

9.998 grammes† pure cane sugar, (corresponding to 10.524 grammes fruit sugar,) the former being $C_{12} H_{11} O_{11}$ and the latter $C_{12} H_{12} O_{12}$, yielded, upon fermentation under the influence of beer yeast, the chemical elements of which appear to have no agency in the reaction—

Absolute alcohol	5.100 grammes.
Carbonic acid	4.911
Glycerine	0 340
Succinic acid	0.065
Cellulose and undetermined matter	0.130
	10.546

Glycerine and succinic acid are present in all our alcoholic drinks, as wine, beer, and cider, constituting a portion of what is known as extractive matter. These substances, when mixed in proper proportions with dilute alcohol, impart a remarkable vinous flavor to the mixture. The fragrance or bouquet observed in old wines is due to very minute quantities of oenanthic* and acetic ether, &c.

Assuming, as has hitherto been generally done, that grape or fruit sugar is simply decomposed into carbonic acid and alcohol, the following equation will represent the reaction:

$$\underset{\text{Fruit sugar.}}{C_{12} H_{12} O_{12}} = \underset{\text{Carbonic acid.}}{4\, C O_2} + \underset{\text{Alcohol.}}{2\, C_4 H_6 O_2}.$$

It follows that 180 parts of sugar are equivalent to 92 parts of alcohol, or two parts of sugar (nearly) to one part of alcohol. Hence no fermented wine can ever contain of alcohol more than one-half the original amount of sugar in the grape juice. When the amount of sugar greatly predominates, as in southern wines, the yeast loses its power before all of it is decomposed; hence such wines taste sweet. Northern wines, on the contrary, taste sour; for the grape juice contains rather an excess of albuminous matter, which by being turned into ferment is able to decompose not only all the sugar present, but even large additional quantities. This is clearly witnessed in the preparation of sparkling wines.

The color of red wine is derived solely from the skins of blue or black grapes, the dyeing principle of which is soluble in dilute alcohol, or, which is the same thing, in fermented wine. It is a flagrant error to believe that red wines are made of blue grapes and white wines of white grapes. Allowing as exceptional that this is sometimes the fact, it is safe to estimate that over three-fourths of

† 1 gramme is equal to 15.4 grains.

* This most essential odoriferous constituent of wine is a fatty ether originating evidently from a fatty acid. It can be shown that a common sugar solution will assume a vinous smell when it is mixed during fermentation with some fatty emulsion like that of grape kernels, of nuts, or of almonds. It has even been stated that a piece of stearic acid dissolved in starch added to any liquor undergoing alcoholic fermentation imparts a vinous aroma to it.

all wines are manufactured from blue grapes, which are generally much the sweetest. The coloring matter is contained in the skins only. To prepare white wine from dark grapes the crushed fruit must be pressed out shortly, and thus separated from the must. For red wines both skins and juice are exposed to fermentation. Very frequently even the stems are crushed with the berries and the mixture suffered to ferment. Such wines, containing tannin in large quantities, are very astringent, and excellent as summer drinks in our climate, where bowel diseases are so frequent. White grape wine can be rendered of the same astringent character by causing it to undergo the same process.

During fermentation a certain amount of saline matter called argol is deposited. It consists of acid tartrate of potassa (cream of tartar) and some tartrate of lime mixed with the spent yeast, and, in red wines, with the coloring matter. The salts in question are but sparingly soluble in water, and much less so in dilute alcohol. The so-called ripening of young wines by age or storage, thereby rendering them milder and less acid, depends on this removal; and it is for this reason also that grapes alone furnish good and wholesome wine. The malic and citric acids of currant, gooseberry, rhubarb, and other similar wines cannot be thus removed, and the excess of sugar usually added merely disguises and masks the natural and permanent acidity of such drinks. Their use in Europe is confined to places where the climate forbids the grape culture.

From the very first moment fermentation sets in or can be traced by the evolution of gas, when a drop of the liquid is brought under the microscope we observe the presence of minute globules or cells having an elliptical form, and varying from 0.005 to 0.01 of a millimetre (being about $\frac{1}{4000}$ to $\frac{1}{25000}$ of an inch) in diameter. These cells multiply by budding, *i. e.*, branches shoot forth from one or more parts of the cells' surface, which, having acquired a certain growth, separate from the parent cell. The new cells rapidly acquire their full size and repeat the reproduction, which frequently indeed commences before they are detached from the parent. (See Fig. 2.) Closely to the elastic cell walls adheres a gelatinous albuminous mass, Mohl's primordial utricle. The hollow centre or lumen of these cells is filled with a clear liquid; its nature is proved by the movements of granules, one or more of which are present in young, fresh cells, increasing in number and almost filling up the central portion of these vesicles in old or exhausted cells. This fact is exhibited by the wine lees, made up of spent yeast cells, which, after fermentation has ceased, become specifically heavier than the wine and sink to the bottom.

Any vegetable containing a good deal of starch,* such as our cereals, Indian corn, potatoes, &c., may yield alcoholic drinks, since amylaceous matter may be converted into dextrine and finally into grape sugar by the action of diastase, a nitrogenous substance which is developed during the germination of barley and other grains, (malting.) The manufacture of beer, whiskey, &c., depends upon this principle. The yeast of beer, deriving its nutriment from the soluble nitrogenous portion of the grain, during the process of fermentation is a yellowish soft mass, identical with the fungi already described under vinous fermentation. From the fact that a certain amount of yeast is required for the complete decomposition of a given quantity of sugar, it is generally assumed that during the act of fermentation a portion of the yeast is exhausted or destroyed. When, however, the sugar solution contains at the same time an abundance of nitrogenous substances the quantity of yeast may be found to have increased six or seven fold after fermentation, as is well known to brewers. Pasteur finds that albuminous substances are not necessarily required for the increase of yeast.

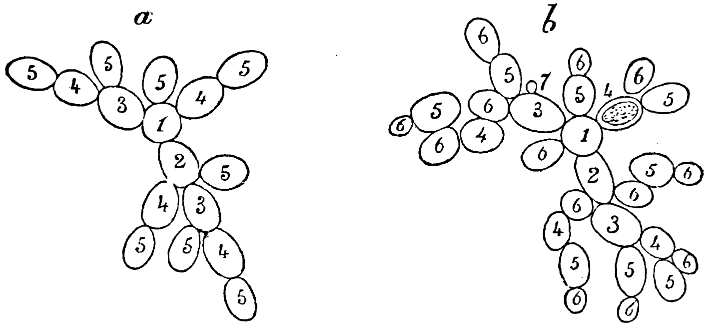
* According to Berthelot substances containing what may be called sugars in the widest sense of the word, such as glycerine, mannite, dulcine, sorbine, also gum and starch, may, when brought together with carbonate of lime and nitrogenous animal integuments at a temperature of 40° C., equal to 104° Fahr., undergo fermentation with formation of alcohol.—*Annal. Ch. Phys.*, *L*, 322; *Compt. Rendu*, *XLIV*, 702.

He shows that a salt of ammonia may be substituted instead, provided the proper quantity of sugar and inorganic matter, such as phosphates, &c., are present. The following mixture will be found to be an appropriate one:

10 grammes sugar candy; 0.1 gramme tartrate of ammonia; 1.0 gramme ashes of yeast, and an imponderable quantity of yeast to start the operation.

According to Mitscherlich there exists a difference in the modes of propagation between the so-called upper and lower beer yeast. While the former, as already shown when speaking of fermenting wines, is multiplied by budding, the latter is propagated by cell division, *i. e.*, the membrane of the mother cell bursts and discharges granules or spores into the liquor, where they grow like seeds and each is developed into a new parent fungus. He observed that a single cell of upper yeast gave, within three days, origin to thirty more; the fourth day only one was formed, and none at all after that.* Six distinct cell generations had thus been developed, and on the mother cell one bud had started belonging to the seventh, (see Fig. 1, *b.*)

Fig. 1.

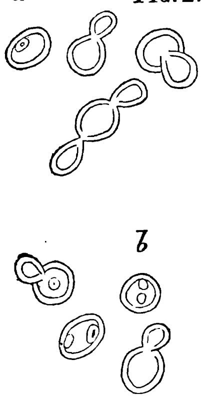


The following drinks are derived from upper or quick fermentation, viz: grape and fruit wines, English beer, ale, porter, our American summer beers, and white beer, which in Germany at least is made of wheat. It takes place at a temperature of from 21 to 27° C., (equal to from 70 to 80° Fahr.) The first signs of action appear in six to eight hours, and, the process becoming active and stormy, is generally finished in from 45 to 60 hours. A higher temperature, as in summer, is apt to produce acid fermentation. The true lager beer, also called Bavarian beer, is obtained by lower or slow fermentation, which takes place at a temperature below 10° C., equal to 50° Fahr. It is less active and violent in its action and continues for seven or eight days and more. In this country this process is usually carried on in winter, but, when good cellars of a uniform temperature can be obtained, it will succeed equally well in summer. In the upper fermentation, by the violent evolution of carbonic acid gas, the yeast globules are carried to the surface, forming a thick scum; while in the lower fermentation, as it proceeds slowly, the yeast separates at the bottom of the liquor. This difference in phenomena has given rise to the names employed. In breweries the upper fermentation is allowed to proceed with a very limited access of air, *i. e.*, in rather high narrow tanks or in casks kept nearly full to favor the separation of the yeast, which is collected as it runs over. Lower fermentation is carried on in low and wide tanks, the air having free access. At this low temperature no risk is run of acid fermentation.

* This process of multiplication was observed microscopically by bringing some yeast cells of white beer together with an extract of malt. A drop of the mixture is then put upon an object glass, covered with a thin glass, which latter is sealed air-tight upon the former by a melted mixture of two parts of calophonium and one part of beeswax.

With all due regard to so high authority as Mitscherlich we may be allowed to differ from him. In my former experiments I could discover no morphological or physiological difference to exist between upper and lower yeast, and my recent and often repeated examinations of both kinds of yeast, obtained direct from breweries where upper and lower fermented beer is manufactured, warrant no such belief. The upper variety shows a more vigorous and uniform growth, and the multiplication by budding can at all times be witnessed in its various stages of development. The lower yeast cells exhibit more variation in size, and (with the exception of some which appear larger) are generally smaller than upper yeast cells. The propagation of lower yeast seems to go on slowly, and does not reveal itself so readily to the microscope; still I have been able repeatedly to see cells in the act of budding, (see Fig. 2, *b*.) Another proof of their botanical identity is derived from the process of practical brewing. The lower yeast can be converted into upper yeast when the temperature during fermentation is sufficiently raised, and when the yeast thus formed is again employed under like circumstances.

a FIG. 2.



b

To change upper into lower yeast is more difficult, according to practical brewers; still, if the former fermentation is carried on in wide tanks, a portion of the yeast collects at the bottom, and will, if again employed, produce the same feeble action, *i. e.*, form lower yeast. According to Liebig there is this difference between the two processes: In the lower fermentation the oxygen necessary for the transformation of the nitrogenous matter into ferment is taken from the air; while in the upper fermentation it is derived from the sugar itself. If Liebig's view be correct, then vegetable organisms like yeast fungi do not constitute the acting principle, and their presence would be rather a secondary phenomenon conditioned by decaying vegetable matter, to which these attach themselves, and live and multiply like mould or the many fungi found on dead leaves and other parts of plants. We shall presently endeavor to show that this state of things offers but a forced explanation.

Fresh yeast may be preserved by packing it into tight vessels which are then sunk into deep cool wells in order to prevent the access of air. The careful drying of yeast has the same effect, especially when previously mixed with wheat or rye flour or flour and charcoal. Alkalies, such as potash and soda and their carbonates, and even strong soap, exert an unfavorable influence on fermentation, probably acting as solvents upon the contents of yeast cells. Yeast is less energetically affected by a weak solution of carbonate of ammonia and bi-carbonate of soda. The bitter principle of hops adhering to yeast may thus be withdrawn. Old stock yeast may in this way be deprived of its excess of acid. Carbonate of magnesia and carbonate of lime will do the same. Mineral acids, such as hydrochloric, nitric, and sulphuric, weaken or destroy the yeast. Phosphoric acid, however, and especially organic acids such as acetic, tartaric, &c., seem to promote the formation and multiplication of yeast. Everything tending to injure the vitality of the yeast cells will either prevent or arrest vinous fermentation. Thus small quantities of corrosive sublimate, arsenic, creosote, oil of mustard seed, many other volatile oils, and even alcohol, have this effect. Another established fact is that fermentation can only be effected by the immediate contact of yeast with the sugary liquid, as is proved by Mitscherlich's experiment* which will be described elsewhere. Helmholz has also observed that the fermentation of grape juice is not communicated to another portion of juice if introduced into the fermenting liquid in a vessel closed by a bladder.

* Pogg. Annal., 55, 224.

The following experiments upon the cause of alcoholic fermentation were made by me in the course of the year 1847, in the chemical laboratory of Zurich, in charge of Professor C. Löwig. Leaving Switzerland shortly after, and accepting the position of first assistant in the analytical laboratory of Professors Silliman and Norton, at Yale, I gave a lengthy and detailed account of my results in a paper read before the American Scientific Association in 1850, a synopsis of which was published in 1851 in "Proceedings for the Advancement of Science," pp. 143–146. I republish them here because many of my perhaps hasty conclusions have been confirmed since by other chemists, among whom is Pasteur, who is the greatest authority upon this subject, to which he has devoted his life. Another reason for so doing is that these experiments were hardly known on the continent, for neither Mulder, in his "Chemistry of Wine," nor others, make mention of the facts on which I succeeded in throwing some light. Indeed, J. L. Leuchs* publishes since a series of experiments on fermentation, some of which were not confirmed in my earlier experiments, and must be attributed to different causes from those assigned by him.

Others I have since repeated, being again in the possession of a laboratory and microscope, after three years' interruption of study by the war. I give at first the series of old experiments before passing to the more recent observations:

EXPERIMENTS ON ALCOHOLIC FERMENTATION AND ITS CAUSES.

A great variety of experiments were published by Brendecke,† according to which porous substances, as straw, feathers, alum, pulverized charcoal, potato starch, flowers of sulphur, scraps of paper, and even small fragments of some metals, as tin, induced fermentation in a solution of grape sugar, to which some tartrate of ammonia had been added. After this it seemed probable that yeast, consisting undoubtedly of vegetable cells, might, like the substances mentioned, produce fermentation in solutions of cane or grape sugar, not by means of its vital force, but simply by its porosity and looseness. In repeating some of Brendecke's experiments I used grape sugar prepared from honey by means of alcohol, and purified by boiling with charcoal, and cane sugar prepared from white refined sugar, recrystallized from solution in hot water. One part of sugar and eight of water were employed.

First experiment.—Common straw was treated with potash ley to dissolve any gluten it might contain. After twenty-four hours the straw was washed with water, the last traces of potash removed by hydrochloric acid, and finally the straw was perfectly cleansed with water. The solution of cane and grape sugar mixed with such straw underwent no change during four weeks.

Second experiment.—Additions of tartrate of ammonia to such a solution as the above produced no perceptible effect.

Third experiment.—Straw cleansed as mentioned, together with cream of tartar, induced no fermentation in cane or grape sugar.

Fourth experiment.—Pulverized quartz added to solutions of cane and grape sugar caused no fermentation. In the course of some weeks mucor or mould was formed, which fructified and yielded spores. Such was the case not only in this but in some preceding experiments.

Fifth experiment.—A solution of cane sugar was mixed with uncleansed natural straw, in order to see whether it excited fermentation, and if so, to ascertain if it might not be owing to the development of fungi. After twelve days fermentation commenced, and at the same time a microscopic examination of the liquor showed the presence of vegetable cells identical with upper yeast.

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* **Einfluss verschiedener Substanzen auf die Gährung in Artus' Vierteljahresschrift für techniche Chemie, 1861, p. 177.**

† **Arch. Pharm. Bd. 90, p. 10. Pharm. Centralblatt, 1844, p. 881, and 1845, p. 856.**

Sixth experiment.—The same treatment of grape sugar produced the same results, with the difference that fermentation set in some days earlier.

Seventh experiment.—This and the following were made upon yeast. The experiment of Ludersdorff,* who stated that yeast, the organic constitution of which was destroyed by grinding, induced no fermentation, was repeated. After grinding upper yeast all of one day upon a plain ground glass plate, a glance in the microscope taught me the impossibility of annihilating thus the vegetable structure of all the cells, if of any at all. It can easily be comprehended if we remember that the cells are commonly not 0.01 mm. in size.

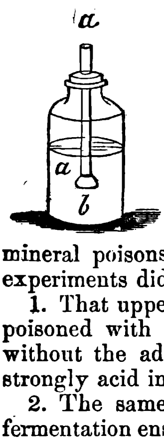
Eighth experiment.—The yeast just mentioned was now for some time digested with pure water, the liquor filtered through very close filter-paper, and poured into a solution of cane and grape sugar. No fermentation could be perceived for some weeks, although filamentous fungi, or common mucor, yielding spores, was present. After this alcoholic fermentation set in slowly, yeast cells being present.

Ninth experiment.—The statement of Quevenne,† that yeast, by continued washing with water, would lose the power of inducing fermentation, was next inquired into. It was found that yeast, freshly washed with water for a considerable time, did induce fermentation in cane and grape sugar solutions. It is no doubt correct that its action may thus be weakened.

Tenth experiment.— Yeast was boiled with water for some time. Upon examination under the microscope the cells appeared to be dead; for while fresh cells appear light or translucent, and of an elliptical shape, those which are boiled seem somewhat changed in outline, granulated, and darker because refracting the light differently. The mucilaginous cell-lining seemed to have undergone considerable alteration.

Eleventh experiment.—In repeating Mitscherlich's experiment, previously alluded to, I took a wide glass tube, or lamp-chimney, (Fig. 3;) one end was closed with a double layer of bibulous paper, *b*, and by means of a perforated cork the tube was vertically suspended in a solution of sugar, *a*, and some yeast, diluted with water, brought into it. The solution of sugar, entering the tube through the bibulous paper, soon commenced to ferment, while the liquid outside remained unchanged. The statement of Latour that the yeast cells, after having induced fermentation, become exhausted, and, under the microscope, appear broken up, their membranes being burst, was not confirmed.

Fig. 3.



Rousseau‡ made known the supposition that fermentation may be induced by yeast, even in the presence of vegetable or mineral poisons, if rendered acid when mixed with the sugar solution. My experiments did not confirm these statements, for I found—

1. That upper yeast, in a cane sugar solution, acidified with tartaric acid and poisoned with arsenious acid, produced no fermentation. The same mixture, without the addition of arsenic, fermented after two days. The liquor was strongly acid in taste, became sweet again, and fermentation commenced.

2. The same trial was made in a liquor acidulated with acetic acid, and no fermentation ensued, while it was produced in the same mixture without arsenic.

3. The two experiments above were repeated, using oil of turpentine as a poison instead of arsenious acid, with the same negative results.

4. Yeast added to cane or grape sugar solutions, acidified with tartaric or acetic acid, and poisoned with a few drops of creosote excited no fermentation whatever.

5. Mixtures of cane and grape sugar with yeast, acidified with cream of tartar

* Pharm. Centralb., 1846, 575. Pogg. Annal. LXVII, 408.
† Journ Pract. Chemi, 14, 307.
‡ Erd. and March. Journ., 29, 267.

and poisoned with considerable quantities of arsenious acid, yielded fermentation. Perhaps, in this case, the arsenious acid formed a chemical compound with the cream of tartar, as such a salt was proved to exist by Mitscherlich.

6. The same experiment repeated, with the difference that in the place of arsenious acid creosote and oil of turpentine were employed, showed no fermentation.

When the poisoned liquors were examined under the microscope, it could be easily seen, when the poison had taken effect, that the nitrogenous layer on the cell-membrane seemed to have undergone a change similar to that produced by boiling.

A number of other experiments on other kinds of fermentation were made at the same time and place, showing that they are due to different kinds of fungi; these will be spoken of under the heads of acetic, lactic, viscous, and butyric fermentation, and other facts adduced which have since been observed by various chemists.

I next pass to the series of experiments instituted by Mr. Leuchs, mentioning only those which I repeated, and which date back to January 16, 1865.

This author states that sawdust and wood shavings of every kind, even when previously boiled in water, excite fermentations in sugar solutions, especially when acidulated with tartaric acid. With these substances he likewise includes cotton, flax, hemp, straw, sulphur, silicic acid, ossa sepiæ, (or cuttle-fish bone,) and precipitated magnesia and alumina.

Experiment 1.—A solution of common New Orleans sugar of the strength formerly reported was mixed with sawdust unwashed. Alcoholic fermentation commenced January 21. The microscope revealed a few yeast-fungi, and the process went on very slowly. In ten days more the liquor yet tasted sweet. There appeared to be more of an eramacousis or decay going on. The sawdust discharged an abundance of bubbles upon agitation. Upon May 5 the surface was covered with a transparent jelly-like mass; the liquor beneath was yet sweet, and, tested by Fehling's copper test, showed the presence of sugar.

Experiment 2.—Commercial grape sugar or starch sugar and common sawdust were employed. Bubbles escaped the second day and beer yeast fungi were present. On the 5th day of May it had become strongly acid, exhibiting lactic acid fungi in abundance. These appear more in links, not threads, but otherwise resemble closely the acetic acid fungi. (See plate, Fig. 10.)

Experiment 3.—Pure cane sugar and sawdust washed with caustic potash were used. On the 23d of January no evolution of gas bubbles was observed; some mycoderms were present. May 5, it was lined with a skin of mould at the bottom of the bottle, and the liquor tasted acid. Viscous ferment, and abundance of lactic acid fungi, but no acetic acid fungi, were present.

Experiment 4.—Common New Orleans sugar mixed with pulverized roll sulphur was employed. Bubbles escaped from the sulphur, especially upon agitation, but no fermentation proper had begun. After ten days the mixture tasted as sweet as ever. On May 5, the liquid was sour, covered with mould, and contained acetic fungi.

Experiment 5.—Pure cane sugar and pulverized sulphur. No fermentation. May 5, the liquid was sweet, clear, and of sulphurous odor; attached to the sulphur deposit there appeared cells (spores) somewhat resembling in size and appearance those of the alcoholic fungi.

Experiment 6.—Pure cane sugar and sulphur. The liquor was acidulated by tartaric acid. No fermentation took place, though after the lapse of a few days a layer of mycoderms attached themselves to the sulphur deposit. Some of these cells were very long, branching out; others were smaller, cycloidal, granular, with two and three nuclei, resembling the mycodermus vini. Upon May 5, the liquid was clear, and contained both free acid and sugar.

Experiment 7.—Solution of commercial glucose by itself. Does not undergo

alcoholic fermentation. Filamentous mould gathers on the top, and the sediment at the bottom consists of minute dots of viscous and some butyric ferment (vibriones); smells like rancid butter.

Experiment 8.—Common cane sugar solution. It had not fermented when examined ten days after. It was afterwards found to contain acetic fungi, especially upon the surface.

Experiment 9.—Pure cane sugar and cotton wool. No change on the sixth day. May 5 it contained a tough, transparent, jelly-like skin, and the ordinary viscous fungi. Some much larger round globules are frequent where this change is going on. (See Fig. 9.)

Experiment 10.—Common cane sugar and cotton wool. No fermentation in ten days. The cotton exposed to the surface had turned mouldy on the fourth day. Later it smells somewhat like rancid butter; contains some viscous and butyric ferment.

Experiment 11.—Pure cane sugar and cotton, acidulated with tartaric acid, gave no fermentation; mould gathered in the liquor.

The experiments of the same writer with silica, magnesia, and alumina, which, he says, produce alcoholic fermentation in grape sugar solutions, (*pure?*) find an explanation in some facts elicited by our first series of experiments. We will only mention that the best imported commercial grape sugar we could procure was very impure, and might very likely ferment by itself. We commonly obtained in such solutions both viscous, lactic, and butyric fermentation.

Brief account of the characteristic distinctions of various kinds of fermentation, together with some experiments which seem to show that different kinds of fermentation are caused by different species of fungi.

According to the principal products formed during fermentation this process assumes specific names, although occasionally one fermentation may speedily pass into another, or, indeed, more than one go on at the same time, different ferments being present.

ACETIC FERMENTATION.

Since this process of acetification is not accompanied by the same evolution of gases, some chemists assume it to be simply an oxidation of alcohol, especially as this alteration may take place without the presence of other organic bodies, as, for instance, when alcohol is brought in contact with atmospheric air and platinum black.

The following chemical formulas will explain the transformation of alcohol into acetic acid diluted with water in our common vinegar:

One equivalent of alcohol, taking up 2 equivalents of oxygen, is at first converted into aldehyd (alcohol dehydrogenatus) or hydrated oxide of acetyl, and subsequently, by a further addition of 2 equivalents of oxygen, into 1 equivalent of hydrated acetic acid.

Thus: 1 equiv. of alcohol $= C_4\,H_5\,O + H\,O$

minus 2 equivs. of hydrogen.... H_2 (combining with 2 equivs. of oxygen from the atmosphere.)

$C_4\,H_3\,O + H\,O$ = 1 equiv. of aldehyd.

Plus 2 equivs. of oxygen O_2

$C_4\,H_3\,O_3 + H\,O$ = 1 equiv. acetic acid.

100 pounds of alcohol require 69.57 pounds of oxygen to form 130.4 pounds of acetic acid, for 1 equivalent of alcohol equals 46 parts by weight; 4 equivalents of oxygen equal 32 parts by weight; 1 equivalent of acetic acid equals 60 parts by weight.

Alcohol of certain strength is permanent, but when diluted (one part alcohol in twenty parts water) and brought together with beer yeast or other albuminous substances at a temperature of 25° to 35° C., (equal to 77° to 95° Fahr.,) it is converted into vinegar, *i.e.*, acetic acid. New wines are more apt to turn sour in the air than old ones, because the latter have been freed from albuminous substances (or lees) by deposition at the bottom of the barrel, from which deposit the wine should properly be drawn off. What has been said of wines applies also to other alcoholic liquors, (cider, &c.,) and even to solutions of sugar mixed with yeast and exposed to the air. According to Bèchamp* every alcoholic fermentation is in some measure accompanied by the formation of acetic acid—an opinion already entertained by Lavoisier. Pasteur considers this an accidental phenomenon caused by the action of air upon alcohol, or an admixture to the ordinary beer yeast of other fungi, (mycoderms,) producing, at the same time with the alcoholic, acetic and even lactic fermentation. Certain it is that the fermentation of grape wine is much more complicated than ordinary alcoholic fermentation of sugar solutions, &c., since the presence of grape stalks, husks, &c., in the former may give rise to the development of more than one ferment, the germs (spores) finding the necessary conditions for their growth prepared in such mixtures.

Pasteur could not detect even traces of acetic acid in champagne wines, and it may be accidental in other wines. It is well known that claret in bottles or barrels rapidly turns sour when the air has access to it, and that mould (fleurs du vin) collects on its surface.

In our older experiments with sugar solutions undergoing alcoholic fermentation we found that at the moment the fermented liquor had, by exposure to air and a more elevated temperature, turned sour from the presence of acetic acid a new fungus had been generated, which is also present in diseased wines as soon as they turn acid and assume an acetous odor.† In our older manuscript, read before the American Scientific Association, these fungi are described thus: "The cells constituting the ferment are very peculiar, being thread-like and jointed, with one diameter frequently five to six times the length of the other. They are usually wave-shaped or bent in various directions."

Now, (fourteen years later,) with superior microscopes, we find this fungus precisely as described and figured by Pasteur.‡ The cells, (our joints,) which are contracted in the middle somewhat like the figure 8, are arranged in rosary fashion. (Fig. 5, *a.*) The length of each joint is more than twice the breadth. The former is, according to Pasteur, 0.0015 mm.

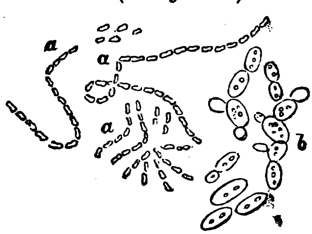


Fig. 5.

This fungus is so minute that it requires a magnifying power of from 600 to 700 linear diameters to see distinctly the contractions, and even a greater one often to distinguish this fungus from that of the lactic fermentation. Some of the single elongated cells, standing on their heads, appear like mere dots. These threads or chains are sometimes more than fifty times as long as a single joint. More rarely (at the commencement?) the cells appear closely together, but not in linear direction.

I. Lower yeast and cane sugar solution exposed in a beaker glass to 26° to 30° C., (equal to 78.8° to 86° Fahr.,) passed in four days into acetic fermentation, exhibiting finely developed acetic fungi.

* Compt. Rend. LVI., 970.

† It might, perhaps, be urged with some show of reason that some of these vegetable fungi were only different generations of one and the same, instead of different species.

‡ Maladies des Vins, Leurs ferments, &c. Compt. Rendu LVIII. No. 3, 1864.

II. White beer, (made in Berlin fashion,) obtained from a Washington brewery, exposed to the air and to the same temperature, turned sour and showed the peculiar acetic fungi. (See Fig. 6.)

III. Several native wines of acetous odor exhibited the same species of fungi.

IV. Two samples of lower beer yeast preserved in water became sour, having the peculiar vinegar odor, and showing the presence of acetic fungi.

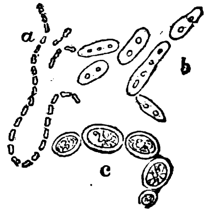


Fig. 6.

In most cases (as observed by Pasteur*) mycoderms, resembling, if not identical with, *mycoderma vini*, (fleurs du vin,) had gathered on the surface in the form of skins. In diseased sour wines Pasteur† found, at times, the mouldy coating on the surface to consist of the acetic fungi (mycodermus aceti) alone, showing that the M. vini is not connected with the former as a carrier of oxygen. The mother of vinegar, collecting at the bottom, consists of extremely minute round cells, (like those appearing in mucilaginous ferment,) bearing no resemblance to the acetic fungi. It seems to have nothing to do with the process proper, and contains a large amount of woody fibre or cellulose.

Pasteur states that the acetic fermentation is always taking place on the surface, just underneath the skin of the mycodermata. He also remarks, that in the quick method of making vinegar the wood shavings serve merely as a support of the mycodermata.

In my experiments I found the first statement confirmed. In two cases where I exposed red catawba and blackberry wines to the atmosphere in open medicine bottles, both containing an abundance of lees, it happened that during four months no mould (mycodermata) formed on the surface. The wines tasted and smelt sweet, and showed no signs of acetic fermentation. Perhaps it is because these wines are strongly alcoholic; for, owing to the bad taste of our people, most wines are mixed with a great deal of sugar during fermentation, or the latter is disturbed or stopped before being completed, by means of alcohol, &c., (a method adopted for favorite ladies' sweet wines in California and elsewhere,) or brandy is added afterwards. One of these wines, after being diluted with water, became covered on its surface with mycoderma vini, whence several days after mycoderma aceti made their appearance also, and the wine had assumed an acetous odor. J. Lemaire‡ states that according to his experiments wine becomes contaminated with acetic acid by direct oxidation, independent of any ferment; he also finds, in opposition to Pasteur, that mycoderma vini when alone present may convert alcohol into acetic acid.

VISCOUS OR SLIMY FERMENTATION.

Under certain conditions white wine, as is well known, becomes diseased, turning "long" or ropy, *i. e.*, it appears slimy or thready when poured from a vessel. The same result can be artificially produced in sugar solutions, and is termed, from the character of the product, viscous fermentation. In our older experiments it happened that pure sugar solutions in contact with straw exhibited viscous fermentation after the lapse of three months. It takes place, according to Defosses, if the relative quantity of ferment present is too small. Artificially it is induced if one part of sugar is dissolved in twenty parts of water, previously boiled with some gluten or washed beer yeast.§

*Bull, Soc. Chim., 1861, 94, and Jahresbericht v. Kopp and Will, 1861, 726.
†Etudes sur les Vins. Compt. Rend. LVIII, 1864, p. 143.
‡Compt. Rend. LVII, 625.
§Defosses and Pélouze.

Ferment of various origin, in contact with sugar solution, at a temperature of 24° to 30° C., (equal to 75.2° to 86° Fahr.,) will probably produce viscous fermentation. Even milk, which has stood a long time near a warm stove, the writer has recently seen to become ropy and viscous, exhibiting upon a microscopic examination the viscous fungi distinctly.

It is always readily induced, according to the directions of Pélouze and Gélis for producing butyric fermentation, which, in this case, it always precedes. To a dilute sugar solution we add milk-curd (caseine) and a considerable amount of chalk powder, exposing the mixture to a temperature of about 25° C., (equal to 77° Fahr.)

The second or third day, and sometimes later, the liquor becomes turbid, and gas bubbles of carbonic acid evolve slowly and sparingly. It has often happened to me in inducing this fermentation that the liquor occasionally became very thick. This slime may be readily precipitated and purified from admixtures by alcohol, when it forms a colorless jelly or mucilage. The fungi which we believe to give origin to this process are always the same in appearance, being of the minutest size, and even smaller than the acetic fungi. The cells are spherical, and oftentimes many are joined together. (See plate, Fig. 7.) With my micrometer, divided only into thousandths of an inch, I could only guess at their size. They measure, according to Pasteur, .0012 mm. in diameter. The products of this viscous fermentation are, according to the same chemist, mannite and gum, formed according to the following equations:

$$\underset{\text{Grape sugar,}}{25\,(C_{12}H_{12}O_{12})} = \underset{\text{Gum,}}{12\,(C_{12}H_{10}O_{10})} + \underset{\text{Mannite,}}{12\,(C_{12}H_{14}O_{12})} + \underset{\text{Carbonic acid}}{12\,(CO_2)} + \underset{\text{water.}}{12\,(HO)}$$

One hundred parts of sugar yield nearly 51.09 parts of mannite, and 45.5 parts of gum. The relative quantities of gum and mannite may vary, as it seems. Pasteur states that when, during this process, more gum than mannite is formed, a fungus is present, consisting of larger globules, to which he attributes the cause of this.

I find these larger round cells of $\frac{1}{6000}$ to $\frac{1}{8000}$ inch in size, and resembling vinous fungi, almost always present when milk-sugar solutions, or the Pélouze chalk and sugar mixture, undergo viscous fermentation. The cells exhibit thick walls, and consequently a small lumen or centre.* They appear to multiply by budding, and numbers of them are frequently joined like beads on a thread. (See Plate, Fig 8 *a*, and 9 *a*.)

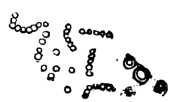


Fig. 9.

Tannic acid also precipitates the viscous matter thus produced, whence a timely addition of this substance to wine which is becoming ropy may effectually remedy the evil. It is for this reason that ropiness is not observed in astringent red wines. It most frequently takes place in wines containing a good deal of free sugar, like Italian and other southern wines, which do not keep, and when exported have to be mixed with brandy or alcohol.

LACTIC FERMENTATION.

The preparation of sauer-kraut from white cabbage furnishes a common illustration of this process. Malt, (diastase,) when suffered to putrefy for a few days in water, acquires the power of acidifying the sugar which accompanies it, lactic acid being formed. Wheat flour (gluten) made into a paste with water and left for nearly a week in a warm place becomes a lactic acid ferment. Slightly decomposed animal membranes, such as are employed in cheese-making in Switzerland, act energetically as lactic ferments. Commercial dextrine solution mixed with some gluten passed repeatedly, in our experiments, into lactic acid

* They resemble but are not fat globules, for ether does not dissolve them.

ferment, as did also a solution of purchased milk-sugar by itself. Sugar solutions mixed with caseine and chalk pass gradually from the viscous into the lactic and terminate in butyric fermentation.

The finest exhibition of the simple and unmixed lactic fungi I obtained once by bringing into very dilute alcohol, perhaps of less than 10 per cent. strength, curd of milk precipitated by acetic acid, and washed by water. The mixture placed near a warm stove showed no perceptible alteration for two weeks, but after that time lactic fermentation took place, presenting the plainest and finest lactic fungi I have ever obtained, after years of devotion to this subject. Fig. 10 gives a representation of them.

It consists of minute drum-stick-shaped cells, often united in rosary fashion. This fungus might easily be confounded with the acetic ferment; the cells are, however, ordinarily longer and less contracted in the middle.

Pasteur found it present in diseased wines of the Jura.* Mulder never could trace lactic acid in red Bordeaux.†

On the continent of Europe the use of *leaven*, causing the rising (sponginess) of bread, is of great antiquity. It is itself in a state of incipient decomposition. It excites, when mixed with large additional quantities of fresh dough containing some glucose and dextrine, according to the older notions, alcoholic fermentation; while Pasteur attributes the active process rather to lactic fermentation. The following is the average composition of the principal wheat flours consumed in France:

	Unbolted flour of native wheat.	Flour of hard wheat from Odessa.	Flour of soft wheat from Odessa.
Water	10.0	12.0	10.0
Dry gluten	11.0	14.6	12.0
Starch	71.0	57.6	63.3
Glucose	4.7	8.5	7.4
Dextrine	3.3	5.0	5.8
Bran	0.0	2.3	1.5
	100.0	100.0	100.0

The following method of preparing leaven or rising is adopted in the Parisian bakeries:

The leaven being left for seven or eight hours in a gentle and uniform temperature, swells visibly and disengages an alcoholic odor, when it constitutes what is called *head yeast* (levain de chef.) It is kneaded with a quantity of water and flour sufficient to double its volume, still retaining the consistence of a firm paste, and is again allowed to rest for six hours. After this time, when the paste has become *levain de première*, an additional quantity of water and flour is added, and it is again mixed, the proportion of water being greater than in the previous operation, which process yields *levain de seconde*. Lastly, a similar addition is made to the *levain de seconde* as was made to the levain de première, the paste being carefully worked, and a *levain de tous points* obtained, the volume of which should be, in winter, nearly one-half of that of the dough intended for baking, and in summer only one-third. A certain quantity of salt is generally added to heighten the flavor of the bread; ½ kilog. of salt being used for every 150 kilog.‡ of flour in the Paris bakeries.

* Maladies des Vins. Compt. Rend. LVIII, No. 3.
† Chemistry of Wine, by Mulder. Engl. transl., p. 255.
‡ 1 kilogramme = 2 lbs.

The dough is then kneaded. The quantity of water necessary for the formation of the paste being first added to the rising, it is mixed for a long time, in order to obtain a perfectly homogeneous fluid paste, to which the flour is gradually added, and which is then called the *sponge*. When the dough has been sufficiently worked, it is collected into a single mass, then again thoroughly worked by turning it in all directions, and finally let fall into the trough with its whole weight. The kneading being terminated, the dough is divided into *loaves*, which are weighed to ascertain if they reach the legal standard, according to which 115 or 117 parts of dough should give 100 parts of baked bread. They are then dusted with flour or Indian corn meal, and placed on tables in front of the oven to keep them at the proper temperature, when more active fermentation ensues, while the loaves gradually swell, until they have attained the proper size to be placed in the oven.

We presume, from analogy, that this process of bread fermentation, like that of this country, is a mixture of alcoholic and lactic fermentation. It affords, in fact, opportunity at all times for the study of the lactic ferment or fungi under the microscope, as we shall show further on.

The fermentation must deviate from the simply alcoholic, otherwise we do not comprehend why bakers and housewives do not resort extensively or exclusively to the use of common beer yeast, always to be obtained in abundance in breweries, instead of preparing in a slow and laborious way their own bread yeast.

Monsieur Bonneaud, a French baker of great experience and excellence in Washington, assures me that the European plan of bread-raising does not succeed in this country, though frequent trials have been made; and it would appear, from our knowledge, that both foreign and native bakers here have adopted a different proceeding. For quick baking, preserved, dried brewers' yeast is made use of in France, and directly mixed with the flour dough.

The following comprises Mons. Bonneaud's process of preparing leaven or rising:

1. One pound of flour and one quart of water are kneaded into paste, upon which is poured a boiling extract of hops (twelve quarts of water for two ounces of hops;) when somewhat cool, four ounces of barley grain are stirred into every two quarts by measure of the former. This, after the lapse of thirteen hours, forms the head yeast, which has to be made fresh every one or two days in summer, and every four or five in winter. It is, when at rest, a thin, somewhat milky fluid, containing a much smaller bulk of yellowish sediment made up of the ordinary vinous fungi. The liquor reveals under the microscope lactic acid fungi. (See Plate, Fig. 11 *a*.)

2. To obtain what corresponds to "levain de première," he takes a peck of potatoes, which, after being well cooked and crushed, are next worked together, thoroughly and well mixed with four pounds of flour. Upon the whole twenty-four quarts of water are then poured, the mixture thoroughly squeezed, and finally four quarts of head yeast added. This is allowed to work for about nine hours. A microscopical examination of this second ferment or paste shows it to be composed of lactic fungi, (see Fig. 12 *a*,) some alcoholic ferment seen in the same Fig. (*b*,) and starch globules, both potatoes (*c*) and wheat (*d*) colored blue by a drop of tincture of iodine; the larger potato fecula, as seen by *polarized* light, (see Plate, Fig. 14,) showing the characteristic black crosses. In about forty-eight hours this ferment assumes a penetrating acetous odor, reddens blue litmus, and a microscopic examination shows it to contain acetic fungi in great abundance, in addition to the lactic and altered alcoholic ferment. (See Plate, Fig. 13.) This readily obtained substance is very appropriate to examine the acetic fungi and compare it with the lactic at the same time.

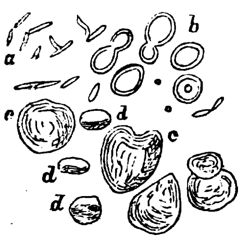


Fig. 12.

3. Lastly, the "levain de tous points" is obtained by using an additional quantity of sixty quarts of water and the necessary amount of flour to make a paste, and the whole carefully worked. This paste is allowed to rest for about one hour to an hour and a half, and divided into loaves, and baked shortly after.

Mons. Bonneaud informs me that in the more southern latitudes of this continent, California, New Orleans, Mexico, and also in Havana, the process followed in Paris succeeds.

We infer hence that the meteorological phenomena, atmospheric moisture, and temperature are conditions upon which this change depends.

In the higher orders of organic creation we meet frequently with instances somewhat analogous to this. Thus the European species of grape, *vitis vinifera*, does not flourish in any part of the United States, except California, where it succeeds admirably, probably only because the atmosphere there resembles that of the continent in its humidity.

The chemical formula of lactic acid is $C_6 H_5 O_5 + H O$; two equivalents of the acid, therefore, contain all the elements of an equivalent of fruit-sugar or grape-sugar—$C_{12} H_{12} O_{12}$. From this it would appear that in lactic fermentation the molecules of sugar merely change their grouping, without any elementary matter being given off or taken up during the chemical process.

BUTYRIC ACID FERMENTATION.

The mixture of sugar in solution (either grape or cane sugar) with chalk and caseine, as directed for viscous and lactic fermentation, when exposed to a temperature of some 29° to 35° C (=85° to 95° F.,) never fails to produce butyric fermentation, carbonic acid and hydrogen gas being evolved during the whole period. Thus this sugar may be transformed successively into a viscous substance, next into lactic, and finally into butyric acid ferment, if the operation is not arrested, as it can be, at the proper moment. The butyric fermentation is not generally completed for some months, and is recognized at the beginning by the peculiar smell of rancid butter, due to butyric acid, which, united to glycerine, is found in small quantities even in fresh butter. This acid constitutes a portion of human sweat, (perspiration,) and has been traced in the pods of *cerotania siliqua*, in St. John's bread or carob tree, in the tamarind, &c. It forms a part of the odoriferous matters of guano, the excrements of man, of birds fed with meat, and of snakes.

This fermentation has an important physiological bearing, since it shows how sugar may be turned into fat. The formula of butyric acid being $C_8 H_7 O_3 HO$, the following equation accounts for the evolution of hydrogen and carbonic acid during the butyric fermentation of sugar:

$$\underbrace{C_{12} H_{12} O_{12}.}_{\text{Sugar.}} = \underbrace{C_8 H_7 O_3, HO}_{\text{Butyric acid.}} + \underbrace{4 H}_{\text{Hydrogen.}} + \underbrace{4 C O_2}_{\text{Carbonic acid.}}$$

In our experiments upon the ferment causing this transformation under different circumstances, we found once that common calcareous sand brought into a sugar solution for the purpose of testing Brendecke's statement previously mentioned, produced butyric acid fermentation after some weeks of time. The sand was afterwards proved not to have been sufficiently washed with hydrochloric acid. The liquor was in time decanted and distilled, the distillate saturated with baryta water, and from the butyrate of baryta, thus formed, the butyric acid separated with sulphuric acid and afterwards distilled. It likewise took place in four weeks by mixing an infusion of commercial dextrine with gluten of flour, also by leaving common milk-sugar solution to itself for several weeks.

In all cases where this fermentation has started and can be traced, there is (besides some lactic fungi, and even the minute viscous occasionally) always a characteristic infusorium present, of a cylindrical shape, and varying much in

length. It seems that sometimes several are attached together, for the cylinder is often bent or broken in appearance. (See Plate, Fig. 15.) These animalculæ assume a lively motion in various directions, and constitute, according to Pasteur, the cause of this peculiar metamorphosis of sugar; he states that they multiply by division, and may be sowed like beer yeast cells, whence they produce again butyric fermentation. A great many mediums are suitable for their nutriment. Even a liquid containing sugar, some ammonia and phosphates serve for their propagation. Singular enough, these infusoriæ live without air. Pasteur states that they are not at all interfered with by a current of carbonic acid passed through the liquid, while a current of air destroys them.

In the liquor undergoing this decomposition we find yet some lactic ferment present, altered optically in some degree; also, in at least the chalk mixture of Pélouze and Gèlis, the dot-shaped viscous fungi. It was the mixing up of these cells, and the unbelief of chemists at that time in the power of living animal ferments to perform such functions, which caused me to describe the butyric fungi as resembling the lactic—only varying in size, and being perhaps the smallest after the viscous fungi.

Preparing and examining recently about a half dozen fermented mixtures of this kind, I must agree with Pasteur's observations, for all of them, as soon as they undergo butyric fermentation, exhibit the presence of minute animal beings which are identically the same.

THEORIES OF THE ORIGIN OF MOULD OR FUNGI, AND OF ANIMALCULÆ

In regard to the origin of these yeast cells, we have to contend with the same conjectures and diversity of opinion as when accounting for the sudden appearance of millions of infusoriæ in stagnant water, or in explaining the origin of intestinal worms.

It has been stated that the yeast cells already existed in the juice of the living grape, and all other kinds of fruit able to yield fermentable juice, such as apples, pears, blackberries, &c. These minute vesicles, it was said, might readily pass through filtering paper, but it is certain that filtered juice of fresh fruit, when examined under the microscope, exhibits no solids, no organized ferment of any kind, but after two or three days, apple or pear juice, for instance, will exhibit yeast fungi, and at the same time begin to ferment. Hence the conclusion is inevitable that we have here to do with a spontaneous cell formation, called *generatio equivoca* or *originaria;* that is, the yeast plant may, without the mediation of a mother plant, originate in a liquid containing, besides water, sugar, dextrine, (gum,) and albuminous matter.

The experiments of Schulze,* Schwann,† and more lately Pasteur,‡ Schroeder, and Dusch,§ favor the idea that the germs of the yeast fungi are diffused in the air and water ready to germinate and multiply whenever a favorable opportunity presents itself, like the eggs of the infusoria which have actually been traced in the air, water, mist, and even snow. Professors Wormley and Sullivant, of Columbus, Ohio, have carefully determined that even with the most powerful microscopes, vision is limited to objects of about $\frac{1}{80000}$ inch in diameter.

Now some infusoria are not more than $\frac{1}{24000}$ of an inch in diameter, and if we suppose that the ova of infusoria and the spores of minute fungi are no more than one-tenth of the linear dimensions of the parent organism, there must be an incalculable amount of germs no larger than $\frac{1}{240000}$ or $\frac{1}{100000}$ of an inch in diameter, which may appear in putrescible liquids unseen, in far greater numbers than the germs in atmospheric dust, visible by the aid of the microscope, would

* Poggendorff's Annal. d. Phys. and Chemie, XXXIX, p. 487.
† Ibidem, XLI, p. 184.
‡ Comptes rendu, 1860, tom. L.
§ Böttger's Polytech. Notizblatt. Jahrgang, XVI, p. 378.

lead us to expect.* Schwann established the experimental proof that when air is first passed through an ignited tube, before coming in contact with the solutions of sugar, containing besides some nitrogenous substances, no fermentation is excited The same negative result is witnessed when the air is conducted through an apparatus filled with concentrated sulphuric acid, (oil of vitriol,) or even a strong solution of caustic potash, (Schulze,) or even when filtered through cotton-wool, (Schroeder and Dusch.) Dr. F. Mohr† makes some recommendations founded upon Schroeder's experiments, among which we will mention that the casks should be closed, after the wine has ceased fermenting, with a bung, through which passes an air-tight glass tube filled with cotton-wool. Thus the air will be sifted of germs as it enters the cask upon the withdrawal of wine by the stopcock. The fermentation previous to that precaution is best conducted in casks *closed* by means of a glass tube bent like an inverted letter U, one leg of which is inserted through the perforated bung, while the other dips into water placed in a vessel. By means of this arrangement all the carbonic acid liberated during the fermentation passes out through the water and can easily be watched, while the air is prevented from coming in contact with the liquid in the barrel. A layer of the heavier carbonic-acid gas on the surface of the liquor makes the exclusion still more complete and prevents the gathering of mould (*fleurs du vin*) though the cask be not full. Without such an arrangement it is impossible to prevent the access of air and spores through the invisible openings and fissures in the staves of the casks. On the other hand a slow oxidation seems desirable, to separate nitrogenous matter and to ripen and improve young wines, whilst the development of the bouquet in older wines seems to be promoted by the exclusion of air or oxygen. This gas, in fact, destroys it when brought in free contact with the wine.

The germs being destroyed by heat, chemical agencies, or mechanically removed from the air, no yeast fungi are formed.

From these facts, Appert's method for preserving different kinds of food may find its explanation. Milk, meat, and vegetables are put into tin cans; these are placed in boiling water and immediately hermetically sealed.

Liebig's explanation is that the trace of oxygen in the air that may still be present with the food is at once taken up by some parts of it without giving rise to the formation of ferment at this high temperature; while Schwann believes that by the destructive influence of the heat on the germs of fungi and infusoria, the food is preserved.

Though the old theory of spontaneous generation, even when limited to some of the lowest orders of vegetable and animal life, is daily losing ground, and the "*omne vivum ex ovo*" has become the axiom with naturalists, still there remain yet many unsettled points in connexion with this matter, which require further investigation. Thus if we take it for granted that, according to Gay-Lussac's experiments, a few bubbles of oxygen gas obtained from chlorate of potassa at a high temperature induce fermentation (when admitted to grape-juice surrounded by an atmosphere of hydrogen or carbonic acid,) it must be admitted that in this case any vegetable germs must have been excluded, provided that those already present in the juice had been destroyed by boiling, and still fermentation took place; and if this be so, were there no yeast plants present? It must also be remarked that in some of the experiments, where the results appeared to favor spontaneous generation a mercurial bath was made use of, to isolate the substances experimented upon. Pasteur has since ascertained that mercury taken from the bath of any laboratory is itself loaded with organic germs. He likewise found that the contact of the atmospheric air with a fermenting liquor is primarily indispensable, only as being a vehicle for the germs of the ferments

* Dr. White's article in Am. Jour. Science, second series, vol. XXXII, 1861.
† Der Weinstock und der Wein: Coblenz, 1864.

Vegetable organisms frequently collect as mould in saline solutions, and decompose them; also even in dilute sulphuric acid. They have never as yet been observed in solutions of chromic acid and chromates, whence these answer well for preserving brains and other highly albuminous anatomical preparations. A solution of tartaric acid will, even when left in tight glass-stoppered bottles, soon become turbid, and lose its acid taste. A microscopic examination will always trace the cause to a formation of mould which feeds upon the acid. The so-called vinegar plant* is a vegetable organism, and acts as a ferment when brought into dilute alcohol. Some mineral waters containing free sulphuric acid, and tasting strongly sour, like that of the Oak Orchard spring, New York, are filled with vegetable mould. Thermal springs of a very high temperature are not exempt from vegetable productions. Even in poisonous liquids containing arsenic, &c., we find some species of fungi which flourish and multiply.

Ehrenberg, the distinguished Prussian naturalist, who has devoted the greater part of his life to the study of infusorial life, is opposed to a *generatio equivoca*, and believes that infusoria are developed from eggs. He has described about eight hundred living species of these microscopic animals, which swarm almost everywhere. They abound in countless numbers even in the fluids of living and healthy animals.

Owing to the extreme lightness of these beings we must not be surprised to learn of their transportation by storms over whole seas and continents. Ehrenberg believes that the baccilariæ found upon some steeples at Berlin came originally from South America.

In the Alps there is sometimes found a snow of a blood-red color; it has been ascertained that this coloring matter is composed chiefly of a one-celled plant (Protococcus nivalis) of the tribe *algæ;* and, what is most singular, when the snow has been melted for a short time so as to become a little warmer than the freezing point, these beings die because they cannot endure so much heat!

The effect of antiseptics in arresting fermentation may be differently explained according as we favor Liebig's or Schwann's theory. The former assumes that corrosive sublimate, arsenic, and creosote, uniting with the ferment, prevent the decomposition of it, and, in consequence, that of other organic bodies with which it is in contact.

Schwann believes that these substances, acting as poisons, destroy the life of the previously described organisms, and that hence the metamorphosis of vegetable substances is arrested by them. We must acknowledge that, notwithstanding the voluminous writings regarding the origin of many of the lowest forms of animal and vegetable life, it is yet a mystery, and that here fancy has as great scope as ever.

The spontaneous change of azotized organic matter called putrefaction is most closely allied to the process of fermentation, being mainly characterized by the evolution of gases of a disagreeable odor, as ammonia, and sulphuretted and phosphoretted hydrogen. For this transposition of elements, moisture, and contact with air, are in the first instance indispensable. It was believed that the animalculæ making their appearance in putrescent substances constituted the primary agent or cause of decomposition; and even if more recent investigations have modified this view, it must be admitted that these minute animals hasten and intensify the resolution of the elements.

Almost the same means mentioned under fermentation will prevent or arrest putrefaction, as—

1. Temperature below 0° C. (= 32° F.)

* I have never succeeded in procuring and examining this fungus. It appears to form a skin, which when brought upon the surface of a sugar solution (or dilute alcohol) converts it speedily into vinegar, and consists likely of the common Mycoderma vini (fleurs du vin) mixed with Mycoderma aceti (fleurs du vinaigre) referred to under acetic fermentation.

2. Perfect drying by pressure at an elevated temperature.
3. Absence of atmospheric air.
4. Application of certain chemicals or flesh preservers, such as wood and coal creosote. The efficacy of smoking or packing in soot is also due to traces of this agent. Bi-sulphite of lime or soda, corrosive sublimate, and soluble arsenites, as arsenite of soda or potassa, are powerful antiseptics, and are principally made use of in the process of embalming.

In the sacristy on the Lago Maggiore, eggs surrounded by lime were found in a wall, well preserved, although they must have been buried for about three hundred years. The carbonic acid gas escaping at the commencement from the eggs, converted the lime into carbonate of lime or chalk, and effectually sealed up the pores,* thus preventing the access of air and moisture. Meat may be preserved for a few weeks in water from which the air has been excluded by boiling, and which is covered with a layer of oil.

Explanatory of the figures.

Fig. 1. Multiplication of upper yeast cells.
 a. Five.
 b. Six generations.
Fig. 2. Beer yeast from breweries.
 a. Upper yeast.
 b. Lower yeast.
Fig. 3. Apparatus for illustrating Mitscherlich's experiment.
Fig. 5. Acetic fermentation; lower yeast in cane sugar solution exposed to the air.
 a. Acetic fungi.
 b. Wine bloom, (mycodermus vini.)
Fig. 6. Acetic fermentation. White beer exposed to the air.
 a. Acetic fungi.
 b. Wine bloom, (mycodermus vini.)
 c. Old granulated upper yeast.
Fig. 7. Viscous fermentation and its fungi in cane sugar solution, caseine, (curd of milk,) and chalk powder.
Fig. 8. The same at a later stage.
 a. Round globules, $\frac{1}{6000}$ to $\frac{1}{3000}$ inch in diameter, not affected by ether, like fat.
 b. Viscous fungi.
 c. Some lactic fungi.
 d. Advanced butyric fermentation, with its characteristic infusoria.
Fig. 9. Viscous fermentation. Old ropy milk.
Fig. 10. Lactic fermentation. Very dilute alcohol and milk curd.
Fig. 11. Liquid portion of bakers' yeast.
 a. Lactic fungi.
 b. Common granulated beer yeast.
Fig. 12. Later stage, (levain de première.)
 a. Lactic fungi.
 b. Vinous fungi.
 c. Potato-starch granules.
 d. Wheat-starch granules.
Fig. 13. Same as the last, having turned sour.
 a. Acetic fungi.
 b. Wine bloom, (mycodermus vini,) (?) or old vinous fungi. (?)
Fig. 14. Potato-starch globules, as seen by polarized light.
Fig. 15. Butyric fermentation and its infusoria, in a solution of impure milk sugar.
Fig. 16. Same fermentation.
 a. Butyric infusoria.
 b. Wine bloom, in a solution of impure glucose.

REPORT OF VARIOUS ANALYSES PERFORMED IN THE LABORATORY OF THE AGRICULTURAL DEPARTMENT.

While engaged in the analysis of sorghum seed I endeavored to extract the red coloring matter with the view of employing it practically as a dye. This use of the seed is known to have been common in China for a long time past.

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*A coat of water-glass or silicate of potash will answer the purpose of preserving eggs better than grease or lime water

FIG. 7.

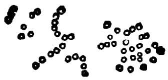


FIG. 8.

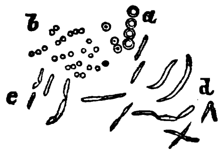


FIG. 10.

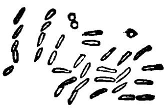


FIG. 11.

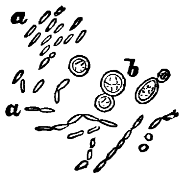


FIG. 13.

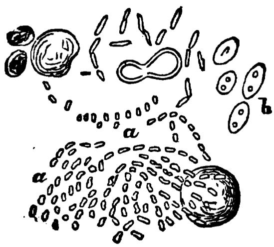


FIG. 14.

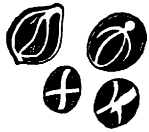


FIG. 15.

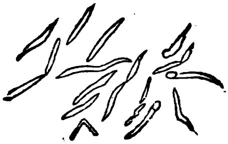
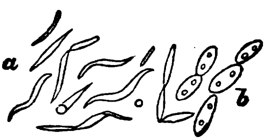


FIG. 16.



The simplest solvent is alcohol, but this being now a most expensive article, ($5 per gallon,) dilute acids were resorted to with very good success, and at an expense and trouble hardly worth mentioning.

The seeds were boiled in vinegar, or in water to which oil of vitriol has been added before heating, until the mixture tastes as acid as vinegar; other acids, such as tartaric, oxalic, &c., can be used, but are more expensive. When the liquid assumes a red, or rather an intense orange color, it is ready for use. The articles to be colored are at once brought into the hot solution, and agitated until the color no longer increases. They are at once removed and dipped into a weak solution of salt of tin, (chloride of tin,) obtained by dissolving tin in hydrochloric acid. They are then exposed to the air for a short time, and washed.

Cotton and silk may thus be colored red; wool turns to a beautiful purple, and an almost unlimited variety of colors and shades may be obtained by substituting for salts of tin other mordants. All the various shades of red, purple, gray, orange, &c., are thus produced from the same bath, the cloths being afterwards drawn through solutions of protochloride of tin, bi-chromate of potassa, sulphate of copper, ammonia, lime water, sub-nitrate of bismuth, &c., &c. Yellow is produced by adding to the seed sufficient nitric acid to form a thick mushy mass. Too much acid will make a straw color.

This dye turns solid by standing, and may thus be stored. To dye silk or wool yellow the solid dye is dissolved in boiling water, the goods dipped into it, and afterwards washed. Cotton has the least attraction for sorghum dyes, while wool receives the brightest colors.

The same dye is developed in the stalks. They, stripped of leaves, and deprived by pressure of the sugary liquid, are heaped up several feet high under a roof. The fermentation, which speedily commences, is conducted in such a manner, by allowing access of air and by frequently changing their position, that not much heating or even putrefactive decomposition takes place.

NEW METHOD TO DETECT ARTIFICIAL COLORING MATTERS IN WINES.

Professor Boettger's* improved proceeding in the distinguishing genuine red wine from that artificially colored was tested. It consists in the use of small pieces of light fine Turkey sponge, deprived of lime, if necessary, by means of hydrochloric acid, washed and dried. He states that the texture of these sponges offers no attraction for the color of genuine wine upon being dipped into it for about three minutes, while the coloring extracts of mallow (malvæ) and huckleberries, (vaccinium,) if present in wine, impart to them colors from a bluish gray to a slate.

The sponges, after soaking three minutes, are washed some fifteen times in common water, lightly pressed between sheets of filtering paper, and the change observed. These coloring matters being not within my reach at the time, I experimented with others with the following results:

1. *Red wine, made of our wild grape, (vitis æstivalis.)*—Sponge dipped in it and dried assumes a scarcely perceptible olive-green hue, not increased by ammonia. Sponges previously mordanted with alum gave nearly the same result.

2. *French claret* imparted hardly any change.

3. *Cherry brandy,* with both crude and prepared sponge, gave the same result.

4. *Port wine.*—The same.

5. *Blackberry wine.*—The sponges assumed a reddish gray color if soaked from three to five minutes. If immersed longer a brownish black was induced.

6. *Alcoholic solution of logwood.*—Unprepared sponge retained apparently no color, but turned distinctly violet in ammonia. Those prepared with alum became at once violet, and in ammonia changed to green.

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* Polytechnisches Notizblatt, Jahrgang, 1864, p. 97.

7. *Alcoholic solution of elderberries, (sambucus.)*—Common sponge was scarcely altered. In ammonia it became somewhat greenish. Mordanted sponge showed a violet shade darker than logwood. No alteration in ammonia.

8. *A slightly alcoholic solution of pokeberries, (phytolacca decandra.)*—At first of a beautiful purple, soon changed, by standing, into a sherry wine color. Sponge, prepared or unprepared, offers no attraction for it.

9. *Aniline red, or fuchsine.*—Owing to the intensity with which it colors a mere trace of dilute alcohol, it is believed that this agent will be employed (if it has not yet been) in coloring wines. Sponge becomes quickly and strangely purple in it, even if only a few drops of an alcoholic solution of aniline are poured in a large quantity of water.*

The following tests were next resorted to to distinguish artificial from real coloring matter in wine:

1. *Wild grape, (vitis æstivalis.)*—Solution of alum rendered it a somewhat brighter crimson red. Alum, and subsequently carbonate of ammonia, gave a light purple-gray precipitate. Acetate of lead, a silver-gray (dove-colored) precipitate. Ammonia, potassa, soda, a greenish brown solution.

2. *Claret.*—With solution of alum no change. Alum and carbonate of ammonia, a silver-gray precipitate. Acetate of lead, a bluish gray precipitate.

3. *Cherry cordial.*—With alum a somewhat darker red. Alum and carbonate of ammonia, a brownish gray or dirty brown precipitate. Acetate of lead, a bluish gray precipitate.

4. *Port wine of doubtful purity.*—With alum and carbonate of ammonia much like wild grape. Acetate of lead, a light gray.

5. *Blackberry cordial.*—With alum a bright red. Alum and carbonate of ammonia, a dirty brown, like the cherry cordial. Acetate of lead, a silver gray.

6. *Elderberry.*—With alum, a violet color. Alum and carbonate of ammonia, a bluish precipitate. Acetate of lead, a light bluish green in small quantities; blue when in excess. Potassa, soda, and ammonia, a yellowish green solution.

7. *Pokeberry.*—With alum, no change. Alum and carbonate of ammonia, a light rust-colored precipitate. With ammonia, no change.

8. *Logwood.*—Alum, dark purple red solution. Alum and carbonate of ammonia, a dirty blue gray precipitate. Acetate of lead, an olive precipitate. Ammonia, a dark blood red.

9. *Aniline red, (fuchsine.)*—With alum, no change. Alum and carbonate of ammonia, a light purple precipitate. Acetate of lead, no change. Ammonia renders the solution colorless.

ANALYSES OF WINES, ETC.

No. 1. *Without mark; a rhubarb wine(?).*—Character: a golden yellow color, of sweet taste, without flavor or bouquet; is evidently a fruit wine or a cordial artificially prepared.

Specific gravity	1.035
Alcohol, (by volume,) per cent	7
Sugar, per cent	13
Free acid, calculated as dry tartaric acid, per cent	0.65

No. 2. *Marked "Pure California brandy," from the New York City agents.*—Character: color, yellow, probably produced by atrace of caramel or burnt sugar; contains no tannin; flavor very pleasant, indicating a mere trace of fusil oil, obtained probably by distilling the residue of grapes.

* We see in a late journal that fuchsine is extensively employed in the coloring of wine As this substance can be manufactured from arsenic great precaution is necessary. Bottger Polytech. Notizblatt, Jahrgang, xx, 1865, p. 203.

Specific gravity	0.935
Alcohol, (by volume,) per cent	49
Sugar, per cent	1.75

No. 3. *California hock.*—Specimen appears to be a young wine. Has not much flavor, and in this respect differs materially from that of German hock.

Specific gravity	0.990
Alcohol, (by volume,) per cent	11
Sugar	Trace.
Free acid, per cent	0.6

No. 4. *California port wine.*—Coloring matter differs somewhat from that of ordinary blue grapes, imparting to the wine a brownish red color. Flavor and taste pleasant, but much unlike genuine Spanish port.

Specific gravity	1.0157
Alcohol, (by volume,) per cent	11
Sugar, per cent	7.14
Acid, per cent	0.37

The bottle was not well corked, and may have lost some of its alcoholic strength.

No. 5. *Pure California Angelica wine.*—Color, yellow; tastes very sweet, like a cordial; flavor poor; appears to be a young wine, and one in which fermentation is not yet completed, *i. e.*, has been arrested.

Specific gravity	1.047
Alcohol, (by volume,) per cent	13
Sugar, per cent	16
Acid, per cent	0.32

No. 6. *California Muscat.*—Colorless; very sweet, like a cordial; bouquet pleasant. In appearance resembles the Angelica.

Specific gravity	1.040
Alcohol, (by volume,) per cent	16
Sugar, per cent	13.16
Acid, per cent	0.3

No. 7. *Spear's Sambuci wine.*—Coloring matter artificial, like that of elderberries, *(sambucus.)* It is more like a cordial, and appears to be artificially prepared.

Specific gravity	1.025
Alcohol, (by volume,) per cent	11
Sugar, per cent	8.33
Acid, per cent	0.8

No. 8. *A rhubarb wine.*—Very poor quality.

Alcohol, per cent	17.80
Grape sugar, per cent	8.33
Cane sugar, per cent	4.75
Acid, calculated as dry tartaric acid, per cent	0.80

No. 9. Character the same.

Alcohol, (by volume,) per cent	5
Fruit sugar, per cent	24.27
Acid, calculated as dry tartaric, per cent	0.90

ANALYSIS OF A LOAMY SOIL FROM VIRGINIA.

Water (at 212°)	14.021
Organic matter and water of combination	7.692
Oxide of iron and alumina	8.556
Lime	4.754
Magnesia	2.521
Potassa	0.243
Soda	0.160
Sulphuric acid	0.190
Phosphoric acid	0.005
Silicates soluble in water	0.320
Insoluble silicates	60.513
Loss	1.025
	100.000

ANALYSIS OF A BLACKBERRY WINE.

Alcohol, per cent	9
Sugar, per cent	10.07
Free acid, calculated as dry tartaric, per cent	0.95

The amount of free sugar present is rather too great.

QUANTITATIVE ANALYSIS OF A SANDY, HIGHLY MICACEOUS SOIL FROM THE "SALT GRASS LANDS" OF VISALIA, TULARE COUNTY, CALIFORNIA, FORWARDED BY W. S. POWELL.

Water (expelled at 100° C.)			1.20
Organic and volatile matter			1.86
Carbonate of lime	0.65	Soluble in water	1.19
Chloride of sodium	0.15		
Magnesia	0.14		
Sulphuric acid	0.25		
Peroxide of iron and alumina	4.81	Soluble in dilute acid	7.54
Lime	1.23		
Magnesia	0.38		
Manganese	Trace.		
Soda	Trace.		
Sulphuric acid	0.35		
Silicic acid	0.47		
Carbonic acid	0.30		
Chlorine	Trace.		
Insoluble mica powder			88.05
Loss			0.16
			100.00

The soil consists of fine powder. Mineralogically, it is almost wholly composed of mica, exhibiting a metallic, golden lustre. This is rendered very obvious by washing the mass with some dilute acid, such as nitric or hydrochloric.

The mica powder gives the following blow-pipe reactions:

1. It fuses to a blackish mass.
2. With borax and other flux it gives the reaction of iron. A microscopic examination shows it to consist of an amorphous mass. Polarized light exhibits no colors.

A hexagonal mica from Monroe, N. Y., has (see Dana's Mineralogy, 4th edition, p. 225,) the following composition:

Silica	39.88	Soda	1.12
Alumina	14.99	Water	1.30
Peroxide of iron	7.68	Fluorine	0.95
Magnesia	23.69	Chlorine	0.44
Potassa	9.11		
			99.16

Analysis of bituminous coal from Edmondson county, Kentucky:

Specific gravity	1.3678
Total amount of volatile matter	53.58
Asphaltum remaining	46.42
	100.00

More accurately expressed, 100 parts of this coal yielded:

Moisture (at 212° F)	3.68
Volatile matter	49.90
Fixed carbon or coke	39.53
Ashes	6.89
	100.00

Analysis of bitumen or asphaltum from Havana:

1. Jet black variety with glassy lustre.

Volatile matter	70.00
Fixed carbon	26.10
Ashes	3.90
	100.00

Four pounds of this asphalt yielded, when distilled in closed retorts, one pint of oil, of specific gravity 0.885; hence one ton of 2,240 pounds would yield, upon distillation, seventy gallons.

2. Dull dark brown variety.

Volatile matter	45.00
Coke	26.55
Ashes	28.45
	100.00

Five and one-third pounds of this asphalt gave one pint of oil, of specific gravity 0.879; hence one ton of 2,240 pounds would furnish in gallons 52+.

Third variety. A semi-liquid viscous tar. This was distilled to ascertain its richness in oil. Thirty-two pounds yielded one gallon of oil, specific gravity 0.866.

Analysis of Mexican asphaltum:

1. Solid variety of black lustre.

One hundred parts gave—

Volatile matter	75.95
Coke	24.05
	100.00

One ton of this material, heated in closed retorts, will furnish 148.75 gallons of oil, of specific gravity 0.897.

Second variety. Semi-liquid, viscous tar.

One ton will yield 89.6 gallons of oil, specific gravity 0.867.

Analysis of two kinds of earth purporting to be guanos, from Cuba.

1. A light, reddish gray, pulverulent earth.

To determine its relative value as a manure, it was quantitatively tested for ammonia, nitric acid, and phosphoric acid, with the following result:

Aqueous moisture	2.000
Volatile matter, consisting of ammonia, nitric acid, and some organic matter	22.000
Amount of earthy matter soluble in dilute hydrochloric acid, consisting of alumina, iron, lime, magnesia, alkalies, and loss, with 1.504 per cent. phosphoric acid	74.175
Insoluble silicates	1.825
	100.000

2. A dark brown, easily pulverized earth, containing some seed-like organic remains dispersed throughout. To determine its nature and value it was tested for ammonia, nitric acid, and phosphoric acid, with the following results:

Aqueous moisture	1.37
Volatile matter, consisting of ammonia, nitric acid, and some organic substances	25.86
Amount of earthy matter soluble in dilute hydrochloric acid, *and made up of* alumina, lime, iron, magnesia, alkalies, and 0.43 per cent. of phosphoric acid	10.63
Insoluble silicates	62.14
	100.00

3. A dark brown, granular mass, principally made up of vegetable seeds which had passed through a process of digestion, and, as I was informed, probably consisting of the excrement of bats. It is my opinion, verified by investigation, that both earths are deposits taken from limestone caves where in time a portion of the mass has been changed into nitrate.

REPORT ON BOLIVIAN GUANO.

I have made a chemical analysis of the two samples of Bolivian guano sent by Pedro Lopez Gama, esq., of Paquica, through the United States consul at Cobija, with the following results:

No. 1, marked "Bolivian guano from the deposits at San Felipe de Paquica," is of a yellowish brown or cinnamon color, and tasteless.

Moisture	4.00
Organic matter and ammoniacal salts	10.00
Phosphate of lime	72.00
Soluble alkaline salts	4.00
Insoluble matter	10.00
	100.00
Total amount of ammonia	0.25
Soluble phosphoric acid	0.00
Phosphoric acid combined with lime	40.28

The alkaline salts contain sulphate of soda and chloride of sodium.

In reporting briefly upon the qualities of Bolivian guanos founded upon chemical analysis, the true criterion of their agricultural and commercial value, I would say that the result fully sustains the favorable opinion of these fertilizers in the European markets.

The preservation and soundness of all these excrementitious deposits must be a limited one, *i. e.*, be confined to certain latitudes where, owing to the total absence of rain, no lixiviation or important chemical change or deterioration can take place. Hence the best cargoes of guano are brought from the Chincha islands, furnishing the Chincha or Peruvian guano, and Bolivia, (formerly Upper Peru,) yielding the Bolivian guano.* Of course even genuine guano must differ according to its age and origin.

To write anything in praise of guano as a powerful fertilizer would in our day be almost superfluous; suffice it to say that, according to Von Martius, the manuring power of genuine guano is at least four times greater than pigeon's dung.

The conclusion arrived at by intelligent farmers is that good guano, properly applied, will produce an increase equal to about 33 per cent. in crops of grain, turnips, potatoes, grass, &c. For garden vegetables, flowers, and grape culture, the application of guano proves highly beneficial, and, owing to the great solubility of guano in water, its action is most energetic and quickly remunerative, affording the highest interest on the farming capital invested.

The fertilizing qualities of guano must be ascribed to its containing—

1. Actual or ready formed ammonia, together with potential ammonia, to be available in future from the organic nitrogenous matter found therein.
2. Phosphoric acid in combination with alkalies and alkaline earths.

According to Liebig the phosphates impart to guano its most important effects; and the higher the percentage of phosphates present, together with a limited amount of ammonia, the more valuable the guano; the ammoniacal contents being, though useful and necessary to plants, obtainable from the atmosphere; hence this *savant* attributes to it rather a secondary importance. Certain it is that a soil in which no phosphates are present is totally incapable of producing wheat, beans, peas, &c. Lean or exhausted lands would be especially benefited by these phosphatic compounds.

No. 2, marked "Bolivian guano from the deposits at San Francisco de Paquica," is of a dark brown color, resembling that of roasted coffee, and tastes salty.

Moisture	9.50
Organic matter and ammoniacal salts	35.50
Phosphate of lime	24.50
Soluble alkaline salts	23.00
Insoluble matter, (sand)	7.50
	100.00
Total amount of ammonia	2.00
Soluble phosphoric acid	5.00
Phosphoric acid combined with lime	6.70

The alkaline salts contain compounds of ammonia, phosphates, chlorides, and sulphate of soda.

This guano bears a stronger chemical resemblance to the Chincha islands guano than No. 1, having a higher per centage of organic nitrogenous matter and ready ammonia, and containing much less of phosphates, and hence it would appear to me to be peculiarly adapted for mixing with the Bolivian guano,

*According to Ure the northern limit of the guano region may be fixed at 14° south latitude, and the southern at 21° south latitude.

marked No. 1, from the deposits at San Felipe de Paquica. So mixed, the commercial value, calculated after the standard of Way, would be about fifty dollars ($50) gold, per ton.

Besides those analyses here mentioned in particular, numerous experiments and investigations have been performed, which space does not permit to be noticed at length.

The whole series of aniline or coal-tar colors and sorghum dyes were prepared for exhibition in the museum of the department, the fabrics employed being silk, wool, and cotton.

I would also add, in closing my report, that a great number of letters of inquiry regarding scientific problems in agricultural and general industry have been answered by me, frequently involving extended chemical or microscopic examination.

The nucleus of a mineral and geological cabinet has been formed, but, owing to the total want of room, could not be arranged for exhibition.

A single room such as is now occupied is entirely inadequate for a national laboratory. Scales, brass apparatus, and even chemicals, are damaged by the great dampness prevailing, to which the acid fumes sometimes unavoidably generated must always add.

There is no space even to arrange my private library necessary for constant reference.

HENRI ERNI,

Hon. ISAAC NEWTON,
Commissioner of Agriculture.

REPORT OF THE ENTOMOLOGIST.

SIR: Before proceeding with my report on noxious insects, a part of which was published in the report of this department for 1863, I deem it proper to make a brief statement of the progress and condition of the agricultural museum now under my charge.

For a new enterprise of this kind, and depending so much as it has done thus far on voluntary contributions, the advance made during the year since its establishment, August 1, 1864, has been very gratifying. Farmers, amateur naturalists, and others have shown an encouraging spirit by sending specimens to add to the collection. Nearly all the States and Territories are now represented in one way or another, by insects, birds, animals, plants, cereals, fibres, manufactures, or some product of industrial art. As soon as received, all articles are registered, classified, labelled, and placed in the division to which they belong, so that they may be referred to at any time; the idea being to make this cabinet a sort of object library where the student in agriculture and natural history may read from one to the other, and so better understand the relation between them.

The growing interest shown by farmers in the study of the nature and habits of insects is a fact worth noting. It is daily evinced by letters received in this department from all classes of farmers in all parts of the country. This is an interest which for the good of agriculture cannot be too much encouraged. The comparatively new regions of the northwest seem specially infested with insects which dispute possession of the soil and crops with the agriculturist, and challenge his ingenuity to rid himself of their claims. Many letters of

complaint have come from that quarter, and some containing specimens of the depredators and accounts of experiments made to destroy them. Whatever hints or results of a beneficial nature have thus come to hand have been embodied in my report, and answers returned encouraging further observation and experiment, and soliciting specimens of all such insects as might be thought new or rare, for preservation in the museum, together with the knowledge that might be gained of their habits, transformations, &c. The most general complaint has been made against the *Doryphora* 10-*lineata*, a leaf-eating beetle known as the "ten-striped spearman," which has been quite destructive to potatoes at the west during the year. We have received numbers of them from various quarters, many supposing that it was an entirely new insect. The same mistake has been made with regard to a number of other insects found preying upon the crops in the newer portions of the country. A letter was lately published in some of the papers stating that the whole west and northwest was "swarming with new and undescribed insects" which threatened to depopulate those regions unless government interfered to put them down as it had done the rebellion. It was urged that a government entomologist be appointed and sent forthwith to scour the forests and prairies with pen and pencil, to arrange, classify, and describe these new hindrances to the progress of civilization. If the writer of that letter had taken the trouble to open the commonest works on entomology, or even to refer to the annual reports of this department on that subject, he might have discovered that those same swarms of insects were old acquaintances of other men, and that his fears arose only from the fact that the knowledge of them was new to him.

The science of entomology has hitherto kept itself too exclusive, too much enveloped in technicalities, to benefit the ordinary reader. To do away with this as far as may be, and to make it a familiar and popular study with the mass of farmers, is one of the leading objects of this cabinet or museum. Here it is intended to preserve a full collection, so that an insect may be identified at any time, and by reference to accurately engraved and colored plates all its transformations may be observed and noted, while an accompanying catalogue gives the food peculiar to it in its different stages. Thus from examination, or by letter, or from reports published from year to year, the farmer may learn the nature and habits of his enemies, and so be prepared to take advantage of them in their most vulnerable state.

A similar system, with the exception of the plates, is pursued in the ornithological division. Each bird has beside it a card with its scientific and common names, and also one describing its habits and food, and, when it is possible to obtain them, the eggs, and small boxes containing the contents taken from their stomachs at different seasons and in various latitudes; thus proving which are entirely insectivorous and may be relied upon as the farmer's friend, and which may not. Such knowledge well disseminated and acted upon will, by encouraging and increasing the breeds of useful families of birds, be of more real value to the agriculturist than half the nostrums invented for the destruction of his insect enemies.

The collection of corns and other cereals has not been greatly increased within the year. This promises to be, and should be, one of the most important and interesting features of the cabinet. As yet, however, the country has not done itself justice in its representations here. A few fine specimens of corn in the ear were received from various sources in the fall and winter of 1864–'65. Ohio has samples of field corn which matures in ninety days from planting. West Virginia, New Jersey, Massachusetts, New York, and some of the northwestern States have each sent a few specimens, most of them of good size and quality, but nothing as yet truly representing the best capabilities of the country in this line, especially of the west. There is no division of this collection examined with more interest by visitors than that of the corns and cereals, and

none which should do greater credit to the soil and its cultivators. Another year we trust will show a marked improvement.

The sorghum division is one of much interest. Ohio has sent a number of fine specimens of sirup, and a greater variety of sugars than any other State. Pennsylvania, New Jersey, Maryland, and Delaware have also both sugars and sirups of excellent quality. New Jersey has the richest and finest specimen of sirup, and Wisconsin the finest-looking sugar. Utah has also sent a bottle of sirup of good quality. Whenever information as to the process of making has been given by the manufacturer it has been placed upon the labels of the jars or bottles, so that the efficacy of the different modes can be compared, and the quality judged by the process employed. It is very desirable, therefore, that donors should specify where any particular method of manufacture has been resorted to, or what substances are used in defecation, crystallization, or other processes. If all donors of articles for this museum will bear in mind that their contributions are kept here not as mere curiosities, but as lessons of instruction to be "read of all men," they will understand and appreciate this suggestion, and greatly aid us in classifying their specimens. Of the sorghum and imphee we now have samples of a variety of seeds, and from them the process of growth and manufacture may be traced through the stalk, the dyes, sirups, sugars, alcohol, and paper, all from this one plant.

Minerals, coals, and coal oils, although, strictly speaking, not coming within an agricultural classification, have, as products of the earth and evidences of industrial art, been thankfully received and placed on exhibition. There are several specimens of each, and among them a sample of the limestone oil rock of Canada, and of the upper sandstone strata from the Pennsylvania petroleum grounds. Also cannel, asphalte, and other coals from different States, with oils, tar, benzine, paraffine, and dyes produced from them. The aniline or coal oil dyes prepared by Dr. Erni, the chemist of the department, have attracted much attention by their variety and brilliancy. The museum is also indebted to Dr. Erni for sorghum dyes, crystallized corn sugar, and other articles of interest.

In papers there is little new, and little of interest aside from the very fine collection of Austrian manufacture from the common corn husk. Successful experiments have been made in the United States to produce paper from sorghum, salt hay, and wood, small samples of each of which have been received.

The division set apart for fibres is quite too small for an advantageous exhibition of the numerous specimens received. As the committee appointed to report on fibres made a thorough examination of this collection for that purpose, it will not be necessary here to refer to the merits of the same for textile uses. A great number of those now exhibited have been found susceptible of being converted into fibrilia, several have undergone the cottonizing process, and some are accompanied by samples of thread or cloth made from them. The finest samples of wool received are from the Vermont Spanish merinoes. There are some superior illustrations of the coarser or combing wools now so much in demand by manufacturers, but as yet the collection is not what it should be.

In connexion with wools, mention may be made of a contribution recently received from B. K. Tully, Russellville, Kentucky, of very beautiful specimens from the fleeces of the Cashmere goat, together with fabrics of various qualities made from the same. The locks are from eight to ten inches long, some of them brilliantly dyed, and of the texture of the finest satin floss. The fabrics made from these fleeces seem very firm, even, strong, and durable. A specimen of the yarn is exhibited, spun on a common flax wheel, and measuring 16,800 yards of single thread to the pound of wool.

Of the results of experiments made with the *Attacus cynthia*, or ailanthus silkworm of China, imported by you for this department from France, I shall be able to speak more fully hereafter, not yet having received reports from all to whom they were distributed for trial.

With the *Bombyx mori*, or common silk-worm, we made a very satisfactory experiment on a small scale, rearing it on the leaves of the maclura or osage orange instead of the morus multicaulis. The worms fed upon these leaves readily, and spun good-sized cocoons, which, when reeled off, proved to be silk of unusual fineness, evenness, and strength. Specimens of this silk are now on exhibition in the museum.

Interesting experiments are being made with one of our native silk-producing insects, the *Attacus cecropia*, of which it is hoped I may be able to speak favorably another year.

For the practical purposes of a national agricultural museum, the two small rooms now occupied are quite inadequate. Already the shelves and cases are overcrowded, and small as the collection seems, comparatively, there is not space to exhibit the half we have advantageously. So great is the interest manifested by farmers and men of all classes who have visited and examined the museum and the system upon which it is founded, I am well convinced that, could sufficient room be given it, the number of contributions would not only rapidly increase, but the usefulness of this division of the Department of Agriculture would soon be manifest in every State and county in the Union. The design mentioned in my last report of furnishing each State and county agricultural society with duplicate models of fruits correctly named, and such specimens of birds, insects, and other articles as may be desired to create a nucleus for local cabinets connected with such societies, will encourage associations as well as individuals to aid in perfecting this collection. It is hoped also that the department will soon be able to afford increased facilities for the same purpose. It is desirable that large additions be made to the collection of model fruits, in order to bring it up to the improvements of the time and keep it there, making it an illustrated volume of reference from year to year.

If agriculture has hitherto lagged behind the other sciences, one great reason is, because less care has been taken to make the study of it attractive. The chief aim of this cabinet is to supply that deficiency as far as possible by instituting a series of illustrated object libraries which shall throw new attractions around the system of agricultural education, pleasing the eye, and through it instructing the mind.

[Concluded from page 579 of Report for 1863.]

ORTHOPTERA.

The order of Orthoptera, or straight-winged insects, includes grasshoppers, katydids, phasmidæ or walking-stick insects, the mantidæ or rearhorses, cockroaches, thrips, and others. The insects of this order generally possess four wings of different textures; the upper pair being like parchment and semi-transparent, and the under pair membranous, transparent, and folded lengthwise like a fan. They have strong jaws for biting, and are very destructive to grass, grain, and vegetable substances generally. The mantis, however, is an exception to this general rule, as it feeds entirely on other insects.

For the destruction of locusts and grasshoppers Köllar recommends the fields to be swept with sheets sewed together two and two, with a bag net in the middle held open by a ring, somewhat like the sweep net recommended on a former page for the jumping field beetle. Harris also advises farmers to sweep the fields with sheets fastened to a pole in the evening when the grasshoppers are perched on the top of the grain, and suggests that when thus caught they may be killed by boiling water and fed to the hogs. He states, too, that if the salt marshes are mowed about the first of July, (in Massachusetts,) the locusts or grasshoppers, being at that time small and unprovided with wings, are unable to migrate, and will consequently perish. Turkeys, fowls, and many of our native birds

feed voraciously on them. In the month of March we shot a bluebird in Maryland with two large grasshoppers in its stomach, and at that time not a single specimen could be found in the open fields by the most diligent search.

The eggs resembling small flattened hemp-seeds, found so frequently in the middle States, arranged in a double row upon various twigs and leaves, are deposited by a species of katydid which devours the foliage of young trees.

Mole crickets, though at present not very common in this country, are very injurious to vegetation in Europe, where they are destroyed in pits which are dug in September two or three feet deep and one foot wide; these pits are filled with cow-dung, and covered with earth. On the first appearance of frost all the mole crickets in the field will resort to this trap, where they can easily be killed. Moles and crows eat them. Curtis states that oil and soap-suds will kill them, and that greasy manures, lime, and soot will assist in banishing them. Harris says that if they should increase so as to become troublesome, they may be poisoned by placing in the vicinity of their burrows "grated carrots or potatoes mixed with arsenic." Arsenic, however, being a deadly poison, great care should be taken in its use. Common crickets may be poisoned in the same way. A common glazed jar with a slice or two of cucumber in it has been recommended as a sort of trap for crickets, into which they jump, but are unable to get out again.

The large black cockroach is very destructive to almost everything in kitchens and pantries. Dr. Harris recommends poisoning them with red lead and molasses enough to make a thick batter. Another remedy is "one teaspoonful of powdered arsenic mixed with a tablespoonful of mashed potatoes crumbled at night about the place they frequent." Both preparations are very poisonous. Some correspondents report that the Persian insect-powder, which is said to be the dried flower heads of the *pyrethrum carneum*, has been used with success when perfectly fresh, but it soon loses its power when exposed to the air. This powder had a curious effect on some Croton roaches we were experimenting with; when sprinkled over them, or placed in a circle and they made to pass over it, for a few steps they appeared very lively, but soon staggered, and after a few struggles fell over and soon ceased to live. The Cultivator of 1863 states that powdered borax sprinkled about kitchens and pantries will exterminate roaches; this is not a poison, and very likely would be as harmless to the insects as cucumber parings, or plaster of Paris mixed with oatmeal and sugar, which have also been recommended and tried without effect. It is said that powder of dried camomile flowers will drive them away, and phosphoric paste is used to poison them. Hard frosts and extreme cold, it has been asserted, will kill the common black cockroach, but we know from experience that the smaller yellow roach, generally known as the "Croton bug," passes the winter under the bark of trees unharmed by cold. This insect generally swarms in buildings where hot water pipes are used for heating rooms. It is exceedingly difficult to exterminate, and nothing is safe from its attacks. Being provided in the adult state with a serviceable pair of wings, it is able to fly from house to house at will. They hide in crevices during the day, but come forth at night to destroy everything eatable. The eggs are deposited in a case containing a cluster of several together. The only thing we have tried which appears to diminish their numbers was arsenic mixed with mashed potato. Red wafers were eaten with impunity; cakes of water color paints, of red lead, vermilion, or cobalt, did not affect them in the least, and our paint-box was filled with pellets of their excrements of every color in the rainbow.

Köllar states that earwigs when in the ear (which is very rarely) may be destroyed by injecting oil and warm water; this might apply to any other insect in the same situation. The earwig, though rare with us, is very destructive in Europe to ripe fruit. It can be entrapped in hollow stems of reeds or other plants, and sometimes hollow claws of lobsters and crabs are used for that purpose.

When fowls are infested with lice, their houses ought to be carefully cleaned and frequently whitewashed with caustic lime; where the houses are very dirty, it has been recommended to add a little corrosive sublimate to the lime, but this substance being very poisonous it might be dangerous. Lard, common lamp oil, or three parts common and one part kerosene, applied with caution to the head and under the wings of infested fowls, will drive the vermin away, but if used too freely may do more harm than good. Setting hens should not have too much grease applied, as it will injure the eggs by stopping the pores of the shell. Kerosene put upon the wood-work about the nests will drive the hen lice away, and sassafras bark or sulphur will have the same effect. Sassafras poles are recommended for fowls to roost upon; and it is said that flour of sulphur mixed occasionally with the food and water given them will clear them from vermin. They should always have a hole or some place filled with wood ashes, old lime, and dry earth, in which to dust themselves.

The thrips is a minute orange-colored or yellow insect found in the ears of wheat; it is said to suck out the juices of the seed, and thus cause the grain to become shrivelled. Dr. Harris says: "This little pest may probably be destroyed by giving the grain a thorough coating of slacked lime."

NEUROPTERA.

The order of Neuroptera, netted-veined or lattice-winged insects, includes dragon flies, (commonly known as mosquito hawks, darning needles, or snake doctors,) May flies, water and caddice flies, golden-eyed or lace-winged flies, &c. They usually have four wings, of which the two hinder are the largest. These wings are crossed by numerous veins arranged like lattice-work or netting. Their metamorphosis is either incomplete or partial; their jaws are strong and used for biting. Almost all the insects of this order are beneficial, as they destroy innumerable noxious insects. The dragon flies especially are very predatory; they pass the larva and pupa state under the water, where they feed upon aquatic larvæ, and they live upon aquatic insects in the perfect or dragon fly state. To be convinced of this last, the farmer has only to watch them sailing over pools of water and hawking after various insects usually found in such situations, which, when captured, are carried to the nearest aquatic plant, where they are leisurely devoured.

The day-flies or ephemera, live in the water in their larva state. The perfect insects may be distinguished by their broader-netted veined wings, and by their having two or three long bristles or hairs at the extremity of the body. They serve as food for fish, and do no injury to the agriculturist whatever.

The caddice flies also spend their larva state in the water, where they inhabit movable cylindrical cases made of sticks, stones, grass, or grains of sand cemented together. In almost any clear stream, these cases can be seen moving slowly at the bottom of the water like animated sticks or stones, the larva protruding only a small part of its body, head, and six legs. These insects are also a favorite food of fish.

We now come to the lace-winged fly, or golden eye, a beautiful green fly with four delicate wings crossed by numerous veins like the finest lace-work, and eyes like burnished gold. It may readily be distinguished by the peculiar nauseous odor some of the species give forth when accidentally crushed in the hand. This insect is highly beneficial, as the larvæ feed upon the plant-lice or aphides which are so destructive to vegetation.

Many farmers may have observed small circular cone-shaped pits or holes in sandy places. These are the work of the larva of the ant-lion, which, having laboriously scooped out the sand, buries itself in the bottom or centre of this pit, where, with the jaws widely extended, it patiently waits for any passing ant or insect; these, when once on the verge of the pit, fall down with the rolling sand

into the jaws of the ant-lion larva, and are speedily dragged under the sand, and the juices being sucked out, the empty skin is cast beyond the edge of the trap. The perfect ant-lion has four large transparent netted-veined wings like the dragon fly, but may be distinguished from it by its longer antennæ or horns.

A species of white ant found mining in the wood of rails, fence posts, in rotten wood, and frequently in cornstalks that have remained on the fields for months, belongs also to the order of Neuroptera. The workers and soldiers have no wings; the former are about one-fifth of an inch in length; the soldiers somewhat larger, with larger head and jaws. They are of a whitish color, with pale brownish abdomen clouded with white. As yet we do not know of any injury of importance they do the agriculturist, as they work almost altogether in darkness in decaying wood or vegetable substances. The foreign species, however, destroy wood-work, trees, and almost everything they come across but metal. The males and females possess wings, but without the peculiar netted veins so distinctly marked in the dragon fly and others.

HYMENOPTERA.

The order of Hymenoptera is composed of insects having four transparent wings with branching veins running through them. The fore wings are generally longer than the hinder pair, and many of the females possess either an ovipositor or tube for depositing eggs, or a sting for either offence or defence. They undergo a perfect metamorphosis. The grub or larva, pupa and perfect insect of the common hive bee may be cited as an example. The insects belonging to this order exhibit the most striking instances of instinct in the structure of their nests or habitations for their young, and in the selection of food for and the rearing of their larvæ. Some of them, such as the saw-flies, the joint-worm, and a few others, are injurious to vegetation.

The larvæ of the saw-flies resemble the caterpillars of moths in their general conformation, but can be readily distinguished from them by always having the fourth segment of the body destitute of ventral feet; whereas the true caterpillars of moths and butterflies always have fourth and fifth segments without feet, and when feeding in companies on the foliage their hinder part is generally coiled in a semicircular form. The fir tree saw-fly is sometimes very injurious to pine and fir trees, as the larvæ destroy the foliage. The eggs are deposited in longitudinal slits made by the piercer of the female in spring. The larvæ are social in habits, and feed side by side upon the leaves. The pupæ are formed in cocoons under ground, and the perfect insect comes out about August to deposit eggs for the second generation. Dr. Harris recommends showering with soap-suds or whale oil soap, and says the larvæ may be shaken off or beaten from the trees early in the morning, when they are torpid and easily fall, and may be caught upon sheets and destroyed. Köllar states that mice and squirrels eat an allied species in Europe.

The grape-vine saw-fly destroys the foliage of the grape; its habits are very similar to those of the fir tree saw-fly. The false caterpillars or larvæ are of a yellowish green color spotted with black, and feed also in societies. To destroy the larvæ Dr. Harris recommends air-slacked lime to be dusted on them, and also on the ground to insure the destruction of those that fall. Also showering with one pound common soap to five or six gallons of water.

The currant or gooseberry worm so much complained of at present is the larva state of another saw-fly. Turpentine will kill the worm, but will also injure the plant. Fresh air-slacked lime or coal ashes is said to be beneficial when dusted over the larvæ while the dew is on; also syringing with whale oil soap and tobacco water. The Cultivator recommends placing a large tin can under the plants and jarring the larvæ into it, when they may be destroyed. The powder of white hellebore (veratrum) is highly recommended for this pest.

It should be dusted over and under the plant so as to come in contact with the insects. It can be blown upon the under side of the leaves by means of a peculiar kind of bellows having the nozzle pierced with small holes like the rose of a watering pot and bent upwards. A late agricultural paper states that two pounds of sulphate of iron (copperas) dissolved in two gallons of hot water and then diluted with ten or twelve gallons of cold water and sprinkled over the bushes with a watering pot will destroy the insects. Both these remedies are poisonous, and should be thoroughly washed from the fruit before it is used. Perhaps gas lime sprinkled over the slugs might also prove beneficial.

The dark greenish, slimy, slug-like larva of the cherry saw-fly destroys the foliage of pear and cherry trees. Rose bushes are also disfigured by a similar slug. The same remedies recommended above may be applicable to these. An insect allied to these, the *Cephus pygmæus*, is found to be injurious in Europe to wheat and rye; the larvæ live and feed in the straw, according to Curtis. This is merely mentioned in order to put farmers on their guard if a similar injury should be found here in the wheat straw.

Ichneumon flies are very beneficial to the agriculturist, as they deposit eggs in or on caterpillars and other insects, and their larvæ live upon the juices of the insect and finally destroy it. Some very minute ichneumon flies even deposit their eggs in the eggs of other insects; in fact, they serve as a natural check to keep down the too rapid increase of several noxious insects.

The joint-worms, of which Dr. Fitch enumerates four distinct species, are very injurious to wheat, rye, &c. The eggs are deposited in or on the stalk, generally near a joint. The larvæ reside in woody galls or swellings in the stalk, their attacks frequently causing the stalk to assume a twisted or distorted appearance. These woody tumors contain several cells, varying in number from six to ten, each cell containing one grub. The late broods live in the woody galls all winter uninjured by frost or wet weather, and come out in the spring as perfect four-winged flies to deposit eggs for the summer generation. We see by this that if the straw is not completely destroyed, farmers will carry the joint-worm to their fields again in the long manure. Even straw exposed all winter in a cattle yard and trodden down by cattle, when examined in spring was found to contain the joint-worm perfectly lively, active, and uninjured. Dr. Harris says that ploughing in the stubble will have little or no effect upon the insects, as the worms continue alive and uninjured under the slight covering of earth, and easily make their way to the surface when they have completed their transformations. The only practical method of destroying them is to burn the stubble containing them, and all the straw and stubble not used for fodder. "A free use of manure, and thorough tillage, by promoting a rapid and vigorous growth of the plant, may render it less liable to suffer from attacks of the insect." Dr. Fitch says: "Cut the grain so high up that most of the worms will be left in the stubble, which set fire to and burn at some dry time in autumn."

The galls or oak apples we see upon oaks are formed by the punctures of a gall fly which belongs to this order of insects, as likewise are the Aleppo galls of commerce, which are much used for making ink, for dyeing, and various other purposes. If one of these oak galls be cut open, it will be found to contain a central cavity or cell in which lies curled up a small white grub. This grub, after having attained the pupa form, changes into a small, blackish, four-winged fly, which eats its way out of the gall and deposits its eggs in the neighboring trees. These galls frequently assume the appearance of warty tumors, as in the case of several galls found on oak and other trees. The cultivated raspberry is subject to such a swelling of the stem, which should be cut off and burned as soon as possible, to prevent the perfect flies from maturing and depositing their eggs on the neighboring plants.

Ants are frequently very troublesome in dwelling-houses. Various means of getting rid of them have been spoken of in the agricultural papers; such as

southern-wood, guano put round their nests in the open air, Chinese crackers fired over their holes, making deep holes in the ground larger at the bottom than the top for them to fall into, creosote or coal tar sprinkled over the places they inhabit, or, if on trees, binding tarred paper around the trunks; but the best remedy we know of to destroy ants when in the kitchen or pantry is to sprinkle sugar or sweetened water over a sponge, and when the ants are collected upon it plunging all into boiling water, repeating the operation as often as needful. It is said that walnut meats or fresh meat will answer the same purpose.

Wasps and hornets are too well known to require any description, and though they destroy other insects, they likewise destroy much ripe fruit. The *Cultivator* of 1863 states that "they may be expelled from their nests by syringing spirits of turpentine into their quarters." Benzine would answer the same purpose, but the operation might be dangerous to the performer. "If the nests are on trees they may be secured by drawing a bag over them late in the evening, and can then be disposed of by scalding or burning; if in the ground, pour tar in and around them." Köllar recommends smothering them with lighted brimstone. Curtis states that humble-bees in England render beans abortive by drilling a hole in the base of the flower into the embryo bud. We have often seen columbines and other flowers with holes cut at the base in a similar manner in this country, but no injury has resulted that we know of except the disfigurement of a few flowers and the loss of a little seed.

For the stings of bees or wasps, Köllar recommends ice water or damp earth applied to the part, or the juice of plantain or grated potatoes renewed every few minutes; but we have found hartshorn or spirits of ammonia most effectual.

Taking the order of Hymenoptera all through, there are more useful insects contained in it than noxious; the saw flies and joint-worms being the principal ones really injurious to the farmer and horticulturist.

LEPIDOPTERA.

The order of Lepidoptera, or scaly-winged insects, includes the butterflies, hawk moths, and moths or millers generally known as candle flies. They have four wings, either wholly or partially covered with very minute scales resembling dust when viewed without the aid of a magnifying glass. Their mouth consists of a trunk, capable of being rolled up, for sucking. The caterpillars, however, have powerful jaws for biting their food. These insects are divided into four classes, namely: the diurnus or day flyers, such as the common butterflies, with antennæ like a thread, ending in a blunt club; 2d, the crepuscular or evening flyers, or hawk moths, of which the common tobacco fly is a familiar example; 3d, the nocturnal or night-flying moths, such as the silk-worm, the cut-worm, and the looper caterpillar moths; 4th, the micro lepidoptera, or small moths, such as the leaf rollers, clothes moths, and others.

The diurnal or day-flying butterflies do very little injury to the farmer, taking them as a class. The natural history of the asterias, a large black swallow-tailed butterfly with yellow spots across its wings, which we so often see in gardens flitting from plant to plant, frequently perching on some gaudy flower and uncoiling its long trunk to extract the honeyed juices, is as follows: The eggs are deposited on the leaves of celery, parsley, parsnips, carrots, and other umbelliferous plants. The larvæ or caterpillars are of a whitish green color, with transverse or cross bars of black spotted with large orange spots. When disturbed, the caterpillar projects from the first segment of the body a pair of orange-colored horns or protuberances which emit a very nauseous odor, most probably to drive away the ichneumon flies. These caterpillars feed upon the leaves, and after shedding their skins several times, attain their full size in 10 to 22 days. They are generally known here as parsley or celery worms. The

chrysalis or pupa is suspended in a horizontal position on sticks, old fences, or any convenient place, and remains in that state from 8 to 16 days. The perfect butterflies come out in June and July, and lay their eggs for a second brood. The last brood pass the winter in the chrysalis state. By destroying the perfect females in the spring before their eggs are deposited we should save the trouble of searching for and picking off hundreds of nauseous-smelling, but beautiful-looking caterpillars from our celery and parsley plants.

We will pass over the other butterflies as not of much consequence to the farmer, as they feed upon forest trees and wild plants in general; merely mentioning, however, the green caterpillar with a light stripe on its sides, which is found so plentifully in clover fields feeding upon clover. This larva changes into the yellow or brimstone-colored butterfly we see so plentifully in summer flitting over the fields or hovering together by dozens over some damp spot in the road. The caterpillars can be caught by hundreds in a small sweep or bag net.

Among the hawk moths the larva of the tobacco fly, commonly known here as the hornblower, appears to do the most injury in this neighborhood. The eggs are deposited upon the leaves. The young worms feed upon the foliage, and cast their skins several times. These worms when perfectly grown are fully three inches in length, sometimes more; they are of a green color, with oblique whitish stripes on the sides, and have a reddish, horn-like protuberance or tail on the top of the hind part of the body.

The potato worm of the northern States is very similar, both in appearance and habits, to the tobacco worm of the south. Both of them are found in Maryland on the tomato. In autumn these worms vary in color considerably, some of them being of the usual green tint, while a few are nearly coal-black, with others of all the intermediate shades. The grape-vine caterpillar also varies in color from green to dark brown. The tobacco worm, when about to change, leaves the plant and buries itself in the earth, where the first brood remains but a short time, and then comes out a perfect tobacco fly, or hornblower. It then feeds upon the honeyed juices of flowers, seeming especially to delight in hovering over the large white blossoms of stramonium, or "Jamestown weed," and the flowers of the tobacco and potato. During the evening twilight, when poised on extended wings with its long proboscis put forth to suck the honey from flowers, it might readily be mistaken for a belated humming bird.

When in Florida several years ago we learned a method of poisoning the tobacco fly which was made known to the public in the Agricultural Report for 1856, p. 66, and which has since been practiced with success in Maryland. One pint of water, one gill of molasses or honey, and one ounce of fly cobalt are put into a bottle, the cork of which has a quill passed through it. This mixture is to be dropped into the cut flowers of the Jamestown weed, or any other upright-growing large flower the flies frequent; they will soon discover the flower, and after feeding upon the nectar, die without depositing their eggs. The *Agriculturist* recommends half a pint of equal parts honey and water to two ounces cobalt, (metallic arsenic.) Mr. W. Shepherd, of Maryland, uses loaf-sugar instead of honey, as less liable to sour, and a quarter of a pound of powdered cobalt to a common tumbler of water and sugar. Plucking the worms off by hand is also practiced. This should be done at least once a week. Turkeys are very useful in destroying tobacco worms.

Some of the caterpillars of the hawk moth feed upon the grape-vine foliage, also upon the apple, plum, and other trees. They may be readily discovered by the injured foliage, or by the frass or dirt which will be found plentifully on the ground under the caterpillar.

The larvæ of the American procris are small caterpillars of a yellow color, with transverse rows of black velvet tufts on each ring, and hairs on each extremity of the body. They measure rather more than half an inch in length and feed in societies upon the leaves of the grape-vine, where they do consid

erable injury. The eggs are laid in clusters on the under side of the leaves in June and July. The pupæ are formed in tough, oblong cocoons in sheltered spots; several broods appear in the course of the season in the south. The perfect insect resembles a small blue-black moth with a bright orange-red neck; their hind body terminates in a broad fan-like tuft. The only way to destroy these insects is to cut off the leaves they congregate upon when they are young, and crush or burn them. Perhaps syringing with whale-oil soap or strong quassia water, or dusting with quick-lime, might be of some utility.

The clear-winged sphingidæ resemble wasps or hornets very much in general appearance; their wings being for the most part merely partially covered with scales, the remainder being perfectly transparent like the wings of a fly. Their caterpillars generally live in the branches and roots of plants, where they feed upon the interior substance. The chrysalides are formed in cocoons in the holes gnawed by the larvæ, and push themselves out by means of recurved spines on the segments of the hinder body. Some of these insects are very injurious, as they cannot be seen working in the interior of the branches, roots and stems, and their presence is not known until the whole plant withers away to the injured part. The peach-tree borer belongs to this class of insects; the larva bores into the bark of the trunk and solid wood, causing the sap to exude in the form of a gum. It generally attacks the tree at or near the surface of the ground, and requires one year to complete its transformations. The pupa is formed in a tough, pod-like cocoon under the bark or in the earth near the tree. The perfect insect appears from June to October in Maryland. The male insect resembles a wasp in general appearance; the wings being transparent with a dark blue band extending nearly across the forward pair, veined and edged with steel-blue. The body is steel-blue, with yellow rings. The female is very unlike the male, and might be taken for another kind of insect. Her fore wings are of a dark-blue color and not transparent; her hind wings, however, are transparent and veined like those of the male. The hind body is of a steel-blue color, with a broad, bright orange belt.

Dr. Harris recommends that after the earth has been removed and the borers dug out and destroyed in the spring, or June, the wounded part should be covered with clay composition, and the trunk surrounded with a strip of sheathing paper eight or ten inches wide. This bandage should extend two inches below the surface of the soil, and be secured with strips of matting; mortar should also be put around the roots to secure the paper. Some people apply cotton bandages or thick paper covered on the outside with tar in the same way. Mr. Peters, of Atlanta, Georgia, banks up the earth in May to the depth of ten or twelve inches, allowing it to remain until November, when it should be scraped from the tree, exposing the collar and main root to the frosts of winter. Dr. Fitch also recommends that the trees be examined every spring to see if gum is exuding between the ground and root; if so, the borer should be cut out and a bank of ashes, air-slacked lime, or earth placed round the tree to the height of a few inches, which should be removed in autumn. The *Cultivator* advises scooping out a hollow round the tree and pouring in a pail of boiling suds, or a quart of wood ashes to a pail of water—suds preferable. The *Agriculturist* recommends scalding water applied in early spring, when the frost begins to come out of the ground. Hot wood and coal ashes are also advised, but these are severe remedies, and we should not like to apply them to any favorite tree of our own. Among other remedies proposed we find copperas, sulphur, tobacco stems, salt and coal tar, to be put round the trunk of the tree. Coal tar, however, might be injurious. It has been stated that iron nails driven into the trunk of a tree will destroy insects in and upon it; but this remedy may be classed among the theoretical absurdities, as trees to which iron rings are fastened to tie horses to, or into which iron nails are driven for hanging clothes-lines, will be found as liable to

injury by insects as any others, although perhaps not so much as those less liable to be shaken or disturbed.

There is a borer in the middle or southern States which attacks the grape-vines much in the same manner as the peach-tree borer; the same remedies might be tried. The squash also suffers from the attacks of a borer in the stem near the roots. Perhaps coal tar, or oil, on sticks or rags placed around the root might drive the insect away before depositing its eggs. Heaping ashes or lime over the main stem might be tried, as then the branches only would be liable to be attacked; whereas, if they once get into the main stem the whole plant dies. Paper, cotton batting, or old cloth placed around the main stem two inches under ground and extending some inches up would prevent the insect from depositing its eggs there, though no doubt the main branches would suffer Cotton batting saturated with coal oil laid over the stem might be a defence, taking care not to let it touch the plant. When a vine is observed to be drooping, it should be examined in the stem near the root, the worm carefully cut out, and the plant hilled up so as to cover the wound. All dying and dead squash vines should be burned at once, as, if left undisturbed, the larvæ will enter the earth, and in due time appear as perfect insects to lay eggs for a future generation. It has been stated that loose tow or cotton pegged down around the plant will prevent the borer from laying her eggs in the main stem, and that the nauseous odor of coal oil or benzine sprinkled over sawdust or rags placed near the young plant will drive the parent fly away. When the plants are small they may be protected by boxes covered with millinet, as advised for the cucumber beetle. The perfect fly is something like the female of the peach tree borer, but has an orange body and extraordinarily clumsy, thick, and hairy hind legs.

The currant borer is the larva of a small wasp-like insect belonging also to this family. It bores into the stem to the pith, which it destroys, thus forming a burrow several inches in length in the interior of the stem, frequently causing it to break off or die. Our currant bushes having been much injured by their attacks, we examined them early in the spring by bending them over, and wherever the worm had been at work the stem either broke or bent more readily than the rest. These stems were cut off below the injury and burned; the result was, that the next year, when we wanted some specimens to figure, there was scarcely one to be found in the whole garden.

Some of the larger clear wings may be frequently seen during summer hovering over flowers, and have been mistaken by many for different species of humming birds.

Among the spinners we find four of our largest native moths, the caterpillars of which spin large silken cocoons. Experiments are being made by Mr. Gallaher, of Washington, in unwinding the cocoons of the *cecropia*, and with gratifying results so far as tried; hitherto they have only been carded. The new *Attacus cynthia*, or ailanthus silk-worm of China, belongs to this family, and is very similar in shape and marking, although not in color, to our native *Attacus promethea*. The cocoon also is suspended to a twig in the same manner, so that it can readily be found and gathered when the leaves are off the trees. Silk-worm gut of very superior quality and length might probably be made from the caterpillars of *Attacus cecropia* and *Polyphemus*. As yet, however, all experiments made with our native silk-worms have been upon a very limited scale. Mr. Sanborn, entomologist of the Massachusetts State Agricultural Society, states that "Mr. Trauvelot, of Medford, has demonstrated that the caterpillar of *Attacus polyphemus* produces a beautiful silk in greater quantity than the common silk-worm, and at far less expense to the cultivator." We understand that Mr. Trauvelot intends to continue the experiments of utilizing the silk of this caterpillar, and is at present conducting them on a large scale at Medford.

The American tent caterpillar forms very large cobweb-like nests in the forks of apple and cherry trees, where they are very destructive to the foliage. The

eggs may be found in winter clustered together around the ends of branches, forming a kind of ring or bracelet covered with a gummy substance to protect them from the effects of moisture. These should be sought out and destroyed. The web-like nests of the caterpillar may be torn down by twisting a brush or a mullein head affixed to a long pole in among them; this should be done early in the morning, at noon, or at night, when the caterpillars are all at home. It is said that kerosene, soap-suds, strong whitewash, or cheap oil, if swabbed on their nests with a mop, will destroy them; burning them off or shooting with powder is liable to injure the trees; fumigation with sulphur has the same objection. Bonfires are used sometimes to destroy the moths; it would be well, however, to be sure that the females fly into the light as readily as the males, as some European authors assert that the males only are attracted. For the fall web-worm the same remedies might be applied, but as their nest is generally on the end of a branch it would be best to cut off branch, nest and all, and then destroy them. No caterpillars' nests should be allowed in trees standing in fences or in hedge-rows, as it is from these that the orchards and gardens are stocked.

The basket or case worm resides altogether in a thick, parchment-like, long oval case, which it constructs of silk, with pieces of leaves, twigs or branches woven into it. This insect may be very easily destroyed by cutting off and burning every case found in the winter, when the leaves are fallen, and they may be seen hanging like chandelier drops from the branches of trees. On evergreens they are more difficult to find. These cases are repositories for the eggs of the insect, and each one contains from 600 to 800. The female is wingless and never leaves her case, and the eggs are found in her body, collected in a mass at the hinder extremity of the apparent chrysalis, while the forepart is filled with a fine brown dust or scales. The males are black, and resemble a black hairy moth or fly, with somewhat transparent wings, especially if the dust or scales are rubbed off. The eggs hatch in the spring, and the young worms make their way out of a slit or opening on the upper part of the thorax of the apparent chrysalis case of the female, and are carried by winds to the neighboring trees, which they soon defoliate. We have seen several cedars killed by them in the neighborhood of Washington.

The beautiful black, red and yellow tufted caterpillar of the Tussock moth can be readily destroyed by examining the fruit trees when the leaves are fallen. The cocoon of the female is fastened to a dead leaf, and has the eggs glued to the top of it, covered with a frothy gum to protect them from the weather. The dead leaf, apparently accidentally remaining on the twig, is most probably fastened by the female when making her cocoon; and as she is not able to fly, having only rudimentary wings, the eggs are always deposited upon it. If the dead leaves remaining upon fruit trees were examined, almost every one would be found to contain some larva, pupa, or insect.

The poplar spinner caterpillar resides in a nest made by drawing two or more leaves together with silken bands. They emerge from this shelter to feed upon other leaves. Branches are often seen almost entirely denuded of foliage, with the exception of a bunch of leaves at the end of the twig where the caterpillars reside. These nests should be sought out and destroyed, with all their inhabitants.

The army worm has been very numerous in several parts of the country, and has done much injury to grain and grass. This caterpillar has obtained the name of army worm from the immense multitudes of them that appear at one time, and from their habit of moving from field to field, eating and destroying all vegetation, after the manner of a hostile army. The *Prairie Farmer* states that the speed at which they move is thirty yards an hour; the *Agriculturist* says two and a half feet per minute, or 200 feet per hour. They begin to travel between two and three o'clock p. m., and do not travel at night. It has been a

disputed question whether the army worm passes the winter as the chrysalis or remains in the egg. Mr. Willey states that they "show themselves in wheat or meadow land, but never in land that has been ploughed in the spring." Dr. Fitch says the army worm is bred "originally in wild grass of swamps, and in dry seasons has unusual feeding range which favors a rapid increase; if the succeeding season be very wet, the swamps are overflown, and the insects driven out among the crops." He therefore advises to drain all the swamps. Mr. Griffin, of Illinois, says, however, that there are no swamps in his neighborhood, but that the army worms originate there in the timothy meadows. To stop their incursions it is recommended to dig trenches around the infested fields, with perpendicular banks on the outsides, up which the worms find great difficulty in crawling, and when the trenches are full, to burn the worms by means of straw laid over them. Dr. Harris advises "a double furrow to be ploughed around the field or across any part of a field they may be marching towards, and it is necessary to have it next the unharmed crops, so that when the worms attempt to crawl over they fall back into the furrow. Running the plough once round is not sufficient; twice or three times is better, and it requires to be renewed if washed by rains. The worms thus trapped may be destroyed by fire or hogs. Thousands of army worms may be destroyed, where the ground is level, by running a heavy iron roller over it. The best time to roll is when the worms are feeding and up among the leaves, for then they are sure to be crushed." Hogs, ducks, chickens, turkeys, crows and blackbirds feed voraciously upon them. Burning the meadows while frost is in the ground has been recommended to destroy the eggs, which, it is asserted by some very good authorities, are deposited in the grass in autumn. Small fires lighted in the fields in the evening will, it is said, attract and destroy multitudes of the female moths before depositing their eggs. These insects, when very numerous, are subject to many parasites. From twenty specimens of the worms we collected, only two came out as perfect moths.

Cut-worms are the caterpillars of a dark grayish or brownish moth. They live in holes in the earth, and at night come forth to cut off young leaves or tender plants of cabbage and other vegetables. Dr. Harris says that soaking the seed in various solutions, rolling it in lime, &c., will be of no use, as the caterpillars do not attack the seed, but live on the sprouts and young stalks. Fall ploughing will turn up and expose the insects to the inclemency of winter, and to the birds; but Dr. Harris remarks that many objections have been urged against this remedy. Manuring the fields with sea-mud is said to be useful. Searching for the worms when they come out to feed, or digging them from their holes near the plant, and killing them, will be the most effectual. Curtis says one-quarter of an ounce of salt dissolved in a quart of water will drive the grub away and preserve the plant, till washed off by rains. "Tobacco water will kill them if it comes in contact with them." "Quicklime will also destroy them put on when the plants are wet. Dry soot dug into the ground is very offensive to the surface grub." Suds made of one pound of soap to ten gallons water, and applied warm until it sinks into their burrows, will cause them to dart out, when they must be immediately killed, as they recover in a few minutes. The *Agriculturist* says that four ounces of aloes dissolved in a gallon of water and applied to the plants will preserve them from the cut-worm. Salt and plaster are highly recommended to be put around the plants or sown over the ground. Smooth holes made with a hoe or rake handle in the hills, or by the plants, will serve as traps into which the worms will fall, and being unable to get out they may be destroyed. The perfect moth of the cut-worm being attracted by light, might be lured and killed as in the manner mentioned for the army-worm moth. Coal tar and water, in the proportion of a spoonful of the former to a gallon of water, will, it is said, drive away the worm without injuring the plant. Where single plants are to be protected, it has been advised "to wrap stiff paper or

walnut leaves around the stem when setting them out, leaving the paper a little above ground, and an inch or two below." The *Cultivator* recommends cow-dung stirred in water to be poured around the plant, so that the solid parts remain on the surface, forming a hard crust through which the worm will not penetrate; rain, however, will soften it. For a similar insect in Europe, Köllar advises lime ashes applied to the land, or lime water in damp weather. If the female moths are attracted by sweet liquids, numbers might be thus killed.

The corn worm is very injurious in several parts of the country, especially in the middle and southern States. The egg is deposited in or on the corn when in tassel. The worm devours the green corn under the husk, which protects it from observation and from the vicissitudes of the weather; the chrysalides are formed in the earth. We have seen a similar insect, if not the same, in the southern States, where it is known as the cotton-boll worm, and is exceedingly destructive to cotton. Moreover, we have fed the corn worm, found on corn, on cotton-bolls, and vice versa, and the moths produced were identical. In the cotton fields of Georgia it was customary to put out plates containing one part molasses and four parts vinegar, which attracted the moths, and in which they were drowned. Perhaps if a little fly cobalt were used the moths would all be poisoned, but bees would be destroyed as well, if the mixture be left out in the day time.

The moth generally flies about twilight or early in the morning, when her eggs are deposited.

Among the measuring worms we find several very injurious to various fruit and shade trees. The canker worm of the northern States is very destructive to the foliage of apple, plum and cherry trees. The pupa is formed under ground. The male moth is winged, but the female not, and late in autumn, or mostly in spring, she crawls up the trunks of trees to deposit her eggs. To prevent her going up the tree for this purpose, circular troughs of tin or lead placed round them and filled with some cheap oil have been used with success; but great care must be taken not to permit the oil to come in contact with the tree. A belt of canvas or of strong paper covered on the outside with tar will answer the same purpose for a short time, but must be renewed often, and the tar also carefully kept from the tree. The trunks of trees should be thoroughly scrubbed below the trough or band with very strong soap-suds, so as to destroy any eggs that may have been deposited upon the bark. Dr. Harris says that India-rubber melted over a gallipot, into which it will gradually drop in the condition of a viscid juice, and which state it will always retain, may be used instead of tar. Old India-rubber shoes would answer the purpose. (The same substance might also be useful to entrap flea beetles if placed on boards near the plants they frequent, or under them, so that when disturbed the beetles would fall upon it.) A belt of cotton placed round the tree proves no hindrance to the ascent of the canker worm. For one of the European span worms Köllar advises "a box frame one foot high around the tree, with a moulding so as to form an angle on the rim of the box; smear with tar under the coping and renew as often as necessary." It would be necessary to cement the ground inside the box with lime or some hard substance, so that no moths that might come up could get through.

The New York measuring worm, according to Dr. Fitch, is injurious to the foliage of elm, poplar, and linden. Last year several larvæ were sent to us from New York as the drop worm which was so troublesome in the streets of that city, dropping upon persons passing, or swinging from branches by a silken thread. This caterpillar was a true looper, having three pairs of legs on the first three segments of its body, and only two behind, so that it moved by bending its back into a semicircle or loop, and when at rest resembled a dead or withered twig in shape, color and attitude. The chrysalis is formed in a loose web; the perfect insect is of a whitish color, and when fresh is slightly tinged with green. Perhaps a strong decoction of quassia or aloes mixed with soap-suds might render

the foliage so distasteful that the worms would not eat it. Tobacco water has been recommended for the same purpose. Poisoning has also been tried, but their numbers remain undiminished. Fumigation with sulphur has been practiced. Bands of paper or cloth smeared with tar would only prevent the caterpillars, when down, from reascending. Insectivorous birds ought to be encouraged in our great cities, especially where there are trees. Squirrels should be banished, as they destroy the birds, young and old. This fact we proved by a tame gray squirrel we had, that, whenever presented with a nut and a bird, always chose the bird, which it would tear in pieces and devour in a few minutes. The European house sparrow lives in cities, and is said to be very destructive to insects, although grain and small fruits in the neighborhood suffer from its predatory habits. As it is found chiefly in and near towns, breeding in the holes of walls and eaves of houses, thronging the housetops and crowded streets even in the midst of the din and smoke of London, where it feeds principally on the undigested grains of horse manure and other street offal, no doubt it would thrive in our cities, also, if the cold of winter were not too severe. Before importing them, however, it would be well to have the advantages and disadvantages discussed and fully understood, so as not to introduce a noxious bird. The European robin red-breast is a useful bird, very tame and interesting, and has a beautiful song, but might be too delicate for this climate.

Some caterpillars are found rolled up in the leaves of fruit and forest trees; the only remedy against them is to pick off the leaf containing the insect and crush it, being sure that the worm does not escape by backing out of its retreat. Apples are very much injured by the small caterpillar of the apple fruit or codling moth. The eggs are deposited in the blossom end of the fruit in the evening; they hatch in a few days and the caterpillar burrows into the fruit to the core. They complete their growth in about three weeks in the summer, and when the fruit drops the caterpillar leaves it, and the pupa is formed in thin, white satiny cases under bark or in sheltered spots. Those larvæ which change into the chrysalis state late in the season pass the winter in that form and come out as moths the next season. Apples which fall from the tree should be collected daily and either steamed or given to the hogs immediately. Dr. Harris says that if old cloth be wound around or hung in the forks of the tree, the apple worms will conceal themselves therein to change into chrysalides, when the cloth may be examined every few days and the inhabitants killed. Twisted ropes of hay or straw will answer the same purpose, and may be wound around and among the principal branches; they should be often examined for the hidden chrysalides. If the loose rough bark of the trees be scraped off every spring, numbers of these pests will be thus destroyed. It is said that smoke of burning weeds will drive away the moths when about to lay their eggs. Thick whitewash stopping up the crevices of the bark would destroy the chrysalides passing the winter there. Bonfires in June evenings are recommended for the moth, and also plates with vinegar and honey poisoned with fly cobalt.

The bee moth, the larva of which is so destructive in beehives, is said to be very fond of sweets. Harris advises vessels set with a mixture of honey or sugar and vinegar to drown them. Köllar says that a flame for the moth to fly into would be of no avail, for the female does not leave the hive till she has laid her eggs, and it is only the supernumerary males that perish. This may also be the case with the sugar and vinegar remedy; and the drowned insects ought to be examined to find if there are any gravid females among them. All the holes and crevices in the hive should be carefully filled, so as to prevent the moths from hiding in them to deposit their eggs. We once preserved a common box hive full of bees, which was badly infested with the worms, by raising it from the stand on pedestals of wood about two inches high, and in form resembling an hour-glass—small in the middle and swelling at both ends. On these four pillars were placed pieces of tin with the edges turned down, like

small inverted tin pans. Several pieces of thick elder about a foot long were then split down the middle, the pith extracted, and three or four notches cut in the sides. When the worms fell to the bottom board they took refuge in the hollow elder through these holes and spun their webs inside. These sticks were examined every morning very early, the worms killed and the traps set again. Smoking the moth out or using turpentine would render the hive unpleasant to the bees and very likely drive them away.

The caterpillar of a small moth is sometimes very destructive to the seed of parsnip, celery and other umbelliferous plants. Curtis remarks that hellebore powder, or perhaps lime and soot, dusted over the umbels would drive them away. One year our parsnips preserved for seed suffered very much from these caterpillars, the whole of the umbels and seed being destroyed. The ground under the plants was carefully examined and even sifted to find the chrysalides, but none were discovered. When throwing the plants away several small holes were observed in the stem of one, and this when split open showed the entire hollow of the stalk to be filled with chrysalides securely webbed up and almost ready to change into moths. All the stalks were at once consigned to the fire, and we were not troubled again with these insects.

The caterpillars of the small moth found flying in granaries, or places where wheat is stored, are very destructive to grain in general. There are two species of them, the first of which is called the angoumois grain moth. The larvæ or worms of this species feed inside the grain on the substance of wheat, barley, oats and Indian corn, forming a cell in the empty husk in which to change to chrysalis or pupa. Grain thus attacked sometimes looses 40 per cent. in weight and 75 per cent. in flour. It is said that a moderate application of heat for a certain time is more efficacious in destroying this insect than intensity for a short time. An insect mill like a coffee roaster, with a temperature of about 170° Fahrenheit, has been used with success. Charcoal is spoken of by Dr. Harris, who states that it does not impart a bad flavor to the grain, or injure its power of vegetating. The same fumigation is recommended by him to destroy the beetle or true grain weevil, so injurious to stored grain.

The second larva of a moth which destroys grain is generally known as the grain moth, or wolf. This larva feeds from the outside of the grain, where it covers itself with a silken web, in the meshes of which particles of the gnawed fragments of the grain, and even the whole grains, are interwoven. The chrysalis is formed in little oval cocoons about the size of a kernel of wheat among the grain, or in crevices of the walls and floors of the bin. Before filling a granary, it should be thoroughly cleansed and whitewashed during the winter if possible, so as to destroy the chrysalides hidden in holes and cracks. For the caterpillar, scattering salt upon the grain is advised; and if salt be powdered and mixed with the grain, the caterpillars will be killed. Salt may also be dissolved in water and sprinkled over the heap. It is suggested that a small parcel of the grain be left undisturbed as a trap for the larvæ, where they are sure to collect when the mass is being stirred or turned over, and where they may be destroyed by boiling water poured over them. When in the moth state, they may be destroyed by burning sulphur and creating sulphuric acid in a close apartment; or they may be attracted by burning lights in the granaries. The grain should be turned at the same time to destroy eggs and young caterpillars.

The larvæ or caterpillars of moths which devour clothes, carpets, fur, feathers, &c., construct little cases of the materials they feed upon, concealed and protected inside of which they move about from place to place, eating and destroying as they go. The articles attacked should be exposed to the air and heat of the sun in June for several hours, and then beaten. Turpentine, camphor, spices, tobacco, shavings of Russia leather, pepper, &c., are said to repel the moth if laid among clothing. The perfect moth may be destroyed by fumigation of tobacco or sulphur, or by exposing them to steam for fifteen minutes, or by a

heat of 150° Fahr. The *Agriculturist* gives as a recipe, 1 ounce gum camphor, 1 ounce powdered red pepper, macerated in 6 ounces alcohol, strained and sprinkled over the clothes to preserve them from moths. Ground pepper is often scattered over the floor before carpets are put down, for the same purpose. We use spirits of turpentine, or, what is still better, strongly scented benzine, to destroy the moth in specimens of stuffed birds and animals, and find it have the desired effect.

HETEROPTERA.

The Heteroptera, or dissimilar winged insects, comprise the true plant bugs. They have four wings, of which the two upper are of a dissimilar texture, the basal portions being hard or leathery, and the end membranous. Their mouths are formed for piercing and sucking, and the piercer which they employ for this purpose is generally folded back under the breast when not in use. Many of these insects emit a peculiar nauseous odor. The common squash bug will serve as a familiar example of this order. Most of them live upon the sap of plants; others, however, destroy other insects by piercing them with their proboscis, and then suck out their juices. These insects live mostly on land; some, however, inhabit water. The water scorpion, boatman, and others, live on the juices of other insects, and possess wings which they use to transport themselves from pond to pond; these journeys are mostly made in the evening or at night. Some of these insects are able to inflict a very severe wound by means of a poisonous liquid ejected from the piercer when in the act of puncturing the flesh. These water bugs may be readily distinguished from true water beetles by the half leathery, half membranous texture of their upper wings, as also by possessing a trunk or piercer, while the true beetles have jaws.

The natural history of the squash bug will give some general idea of the true land plant bugs. The eggs are deposited in little clusters or patches, and fastened to the under side of a leaf, in June or July. The larva, pupa, and perfect insect resemble each other very closely in general form, excepting that the larva has no wings, the pupa imperfect wings, and the perfect insect fully developed wings, with which it transports itself from plant to plant. The larvæ and pupæ live in families, puncturing the leaves and thus draining them of sap. The perfect insect feeds likewise on sap, and deposits eggs for a second generation. The females should be sought for and killed, and the eggs should be destroyed daily. Whatever contributes to bring forward the plants rapidly, and promote the vigor and luxuriance of their foliage, renders them less liable to die by the exhausting punctures of the young bugs. Water drained from a cow-yard, and similar applications, have with this intent been resorted to with benefit. The *Cultivator* advises to leave the ground rough upon the hill and lay a shingle over it, when the bugs will crawl under, and may be found and killed early each morning. Boxes with gauze tops will protect the young plants. A mixture of one part Peruvian guano, and three parts plaster or lime, is said to be offensive to them; also the odor of decaying fish. A strong decoction of quassia might drive them from the leaves, or ashes, soot or lime sprinkled over them prove beneficial. Paper, rags, or sawdust soaked in kerosene are used with effect, the scent being very disagreeable to the bugs. As squash bugs remain all winter in a torpid state under the bark of old trees, stones, or moss, it would be advisable to burn all the dead and decaying wood or trees near the garden. Old stone fences, piles of loose stones, hedge-rows and dead trees are the places where many of our noxious insects spend the winter, and whence they issue forth in spring to deposit their eggs. Innumerable larvæ and pupæ are found in the same places, waiting only for the warm weather to complete their changes. If these places are examined in winter, a large entomological collection may be procured even when frost and cold weather are most severe.

For plant bugs Dr. Harris recommends sprinkling with alkaline solutions, soap-suds, or potash and water, decoctions of walnut leaves or tobacco, and dusting the plants with air-slacked lime or sulphur. Turkeys, chickens and birds will also destroy great numbers. These plant bugs are too numerous to be all mentioned here; the majority of them feed upon the juices of plants, and the remedies recommended for the squash bug will apply to them. Mr. B. D. Walsh, speaking of the capsus, a species of small plant bug, says: "If my own trees were attacked by the capsi, I should go to work early in the morning while they are dull and sluggish, shake them off the trees on a cloth, or crush them between the finger and thumb." Many may also be captured by sweep nets.

The eggs of the chinch-bug are deposited in the earth, where the young are hatched and appear above ground in May and June. The larva, pupa, and perfect insect puncture leaves, shoots, and terminal buds, drawing the sap and apparently poisoning the plant. The perfect insect passes the winter in the earth or in sheltered places. They are very destructive to wheat, corn, oats, vegetables, sorghum, Hungarian grass, &c. It might be swept from the grain by a gauze net. Finely reduced oyster-shell lime might be sifted over the blades when the insect first appears, but it seems likely that burning over the ground before ploughing, or after the infested crop has been removed, will be the only effectual means of destroying them. All the chaff and refuse remaining on the ground after winnowing should be burned also; and a few years' perseverance in this course would tend to decrease their numbers, if not destroy them entirely. It is said that gas lime sown on wheat and corn has banished the chinch bug.

Mr. George R. Laughton, of Plattville, Wisconsin, in a letter written to this department, says: "I wish to report what I think a successful experiment against the ravages of the chinch bug. I sowed on one acre three bushels of quicklime; it affected them no more than so much flour would have done. On the same day (14th June) I sowed one bushel of salt on one acre; in thirty hours afterwards they had all left that piece, moving southeast into a piece of oats, and northeast into the corn. That one acre of wheat was all I saved from ten planted, and from it I threshed seventeen bushels. I feel pretty well satisfied now that had I sown 1¾ bushel rock salt to the acre (not more) by the 1st of June, or from ten days to two weeks sooner than I did, I should have saved my whole crop." With corn, Mr. Laughton recommends a spoonful of salt to be put to each hill.

Some farmers at the west have tried the experiment of sowing Hungarian grass with wheat and other grains, and state that their crops have been saved by the chinch-bug preferring the tender grass. Quails are said to be voracious devourers of the chinch-bug, and if so, should be protected.

The common bed-bug, though wingless, belongs to this order. Washings for the bedsteads of salt and water, corrosive sublimate and spirits, lard and quicksilver, unguentum and lamp oil, chloride of zink, and various other things, are used and recommended. As the insects deposit their eggs in crevices, under carpets, in cracks of the floor, and all secret and dark places they can find, it is necessary that the application of remedies should be very thorough, and that cleanliness should be preserved by frequent scalding and whitewashing. Leunis recommends three ounces of fresh-cut leaves and twigs of the *Juniperus sabina* steeped in one quart of whiskey, and two quarts water poured over it; then letting it remain in the sun or any warm place for several days, draining off the liquid and adding to it half an ounce of arsenic and a little corrosive sublimate. As a protection when travelling, he recommends that the beds be sprinkled with wine, vinegar, or lemon juice.

There is one of the Heteroptera, commonly called the saw-back, (*Reduvius novenarius*,) so named from the large rounded protuberance on the top of the thorax or middle portion of the body which is indented with tooth or saw-like projections. The insect is of large size and grayish color; it feeds voraciously on

caterpillars and other insects, and we advise our readers not to handle it, as the punctures made by its piercer are far more painful than the sting of any wasp or bee. The eggs are deposited in hexagonal clusters, and the insects when young have the hind body of a bright red color.

HOMOPTERA.

The order of Homoptera comprises insects with four wings of the same membranous texture; or having the upper pair leathery, and the under pair membranous. Many of these insects when at rest hold their wings in a sloping position over their body, sometimes like the roof of a house. They are armed with a piercer or sucker, and injure plants by draining them of sap, upon which they feed. Many of them also have the hind legs long and spiney, formed for jumping. The cicada or harvest fly, (commonly miscalled locust,) the frog hopper, the aphis or plant louse, and the coccus or bark louse, belong to this order.

A short description of the natural habits of the seventeen-year locust will elucidate their general habits.

The eggs of the seventeen-year locust are deposited in longitudinal slits or fissures made by the ovipositor or egg depositor of the female in the branches of trees and shrubs. The larvæ when hatched fall to the ground, bury themselves in the earth and feed on the roots of plants and trees; finally, when about to change, the pupa, which resembles the larva and possesses rudimentary wing cases, emerges from the ground, crawls up some tree, shrub or fence, and the skin of the back splitting open, the perfect insect comes forth furnished with perfect wings and capable of continuing its species. Fruit and forest trees and shrubs are sometimes injured by the attack of these locusts, the wounded branches where the eggs have been deposited falling off or withering away. Mr. Yardley Taylor says that the larvæ remain under ground feeding upon roots, and that the perfect insect appears in the same locality only once in every seventeen years. Miss Morris attributes the decline of the pear tree and the failure of its fruit to the depredations of the young cicadas on its roots, but we could never find any such larvæ at the roots of our own diseased pear trees; and this season Mr. Pierce, of Washington, brought several cicada larvæ which he dug up from his orchard while the trees there were in a perfectly healthy condition.

Drops of foam or froth like spittle are frequently observed on deciduous trees, pines, shrubs and herbage; these are caused by the larvæ of the spittle insect, which sucks the juices of the plant and afterwards ejects them in the form of small bubbles. The larva lies underneath this frothy substance, but when about to change, it leaves this covering, the skin splits open, and the perfect insect makes its appearance.

Some of the small leaf hoppers are very injurious to the foliage of grape, vine and other plants. Their presence on the grape-vine can readily be detected by the peculiar whitish-yellow spotted appearance of the leaves as well as by the dried skins of the larvæ which have been shed and adhere to the under side of the leaf. The larva and pupa, as well as the perfect winged insect, are very nimble, and escape by jumping or flying as soon as the vine is touched. Dr. Harris recommends fumigations of tobacco and syringing with solutions of whale-oil soap. Immense numbers can also be caught by means of a lighted candle or lantern placed in a vessel of water or in front of a board smeared with some adhesive substance. This should be done at night, when the insects are at rest on the leaves; the whole vine should then be disturbed, when the insects, flying towards the light, will be destroyed. Perhaps a decoction of quassia and soap-suds, aloes, or a solution of whale-oil soap, might make the leaves distasteful to them, but these should not be applied when the grapes are ripening, as they also would acquire a nauseous, bitter taste. Dusting the vines with fresh-slacked lime might be beneficial.

Fruit trees are often injured by an insect which perforates a row of small holes lengthwise in the twigs or stalks. In these holes the eggs are deposited, and after remaining all winter, hatch in the spring. The perfect insect, depositing the egg, is the buffalo tree-hopper; it is small and shaped something like a beech nut, or humpbacked, and of a greenish color. Whenever branches thus affected are discovered, they should at once be cut off and burned before the eggs can hatch. As we always catch numbers of these insects when sweeping with a bag net for others, that mode of destroying them might be resorted to if they should multiply so as to be very injurious. Mr. Walsh thinks that a pear blight is caused by an insect similar in habits and appearance to this.

The larvæ, pupæ, and insects of the pear tree psilla, puncture the bark of twigs and branches of the pear, and by extracting the sap, cause the twig to droop, and render the foliage beneath them extremely filthy from the accumulation of honey-dew, which exudes copiously from them. Ants are very fond of this so-called honey-dew, and when they are seen very numerous upon the leaves and branches of fruit and shade trees or shrubs, it may be safely concluded that the tree is infested by colonies of either this insect, or plant lice, which also give forth a sweet gummy substance. Köllar advises to brush off the insects with a stiff brush of hog's bristles, which Dr. Harris says would be too tedious here, and suggests washing the twigs with a mixture of strong soap-suds and flour of sulphur before the buds expand, to prevent the female depositing her eggs. A solution of whale-oil soap, applied with a syringe, will kill the insects after they are hatched.

The aphides, or plant lice, are extremely injurious to almost all kinds of trees, shrubs and herbaceous plants, by sucking the sap from the tender shoots and leaves. Mr. Curtis estimates the offspring from a single egg in the course of seven generations to amount to about seven hundred millions. Dr. Fitch says of the grain plant louse, that it commences to breed when only three days old, and produces four young daily; thus, the descendants of a single aphis will in twenty days amount to upwards of two million, and "that they produce young alone; the insects freeze on the stalk in winter, and revive in the spring." If this is the case, it differs from many of the other aphides, which produce living young during the summer, and deposit eggs in the autumn, from which are hatched the spring broods. Curtis says they hatch in sultry damp weather, and that electricity probably causes their simultaneous appearance. For the destruction of plant lice on a small scale, such as individual potted plants or in green-houses, the atmosphere should be kept damp, and fumigations of tobacco smoke used. Ground or rough red pepper is sometimes mixed with the tobacco, but this makes a disagreeable pungent smoke. Sulphur is also used, but injures the plants. A solution of whale-oil soap syringed over them will kill the insects, though if made too strong, will be likely to kill the young shoots, and leaves also. Common soap suds and strong lye are also beneficial, and strong tobacco or lime water. Mr. Sanborn recommends a washing of sal soda. Plants in pots may be immersed for about a second of time in water heated to 120°, which will destroy the insects; a heat of 135° slightly affected the shoots and young leaves of a rose-bush. Quassia and soap-suds might be useful.

When the insects are dispersed over the field, dusting with dry chloride of lime has been recommended by Dr. Fitch; many others have spoken highly of the effects of dusting with lime, or tobacco in powder. Tobacco might do for individual plants, but would be rather expensive for field use. To preserve hops from the aphis, it has been suggested to smear the poles with coal tar in spring, but it would be well to know first whether the plants would not also be affected injuriously. In the grain field we must at present rely principally upon the natural enemies of the plant lice, such as lady birds and lace-winged flies, which constantly feed upon them.

For the woolly aphis on apple trees the *Agriculturist* advises a wash of two parts

soft soap to eight parts water, mixed with lime enough to make a thick whitewash. When the mealy bug, an insect belonging to the same family, infests green-houses, the same journal recommends "one pound tobacco to a pail of water, the fumes of burning sulphur, tobacco, or a solution of one ounce camphor in two quarts alcohol." But burning sulphur, it must be remembered, will kill the plants also.

For subterranean plant lice, which feed upon the roots of plants, Dr. Harris recommends watering with salt water, or with soap-suds if the plants are tender. The apple-bark louse frequently injures the tree by sucking the sap. The real insect itself is covered with a scale or waxy secretion, forming a shell under which it sucks the sap. The eggs are deposited under the shelter of this case, and when hatched the young escape from it and present the appearance of minute mites furnished with legs and antennæ. After wandering about a short time they settle down, insert their proboscis into the bark, and a scaly covering is gradually formed over them. After once settling down the females never move their habitation, the same scale serving as shelter for the insect, a cradle for the young, and a coffin for it when dead. The males pass their larva and pupa state under smaller cases, but finally appear as minute flies. Dr. Harris advises the same soap and water whitewash as for the woolly aphis. A solution of two pounds potash to seven quarts water, or a quart of salt to two gallons water, may be used with effect. Mr. Washburn, of Maine, recommends that the trees be scraped early in the spring and a wash applied, consisting of three pints soft soap, one pound sulphur, three or four pounds lime, and enough clay to make a mixture thick as cream. The orange coccus may be destroyed by syringing the trees thoroughly twice a week, when the eggs are hatching and the young yet unprotected by the waxy secretion, with a solution of whale-oil or soft soap and a little guano mixed with water. As the eggs do not all hatch at once, the syringing should be continued for six weeks at least, so as to kill them as they emerge from the parental shelter. The female after depositing her eggs dies, and the vigorous growth of the tree, caused by the guano water, eventually throws off the dead and tenantless scales.

For lice on cattle, insect powder, ashes, or sand, rubbed down to the skin, have been advised. Sweet oil or grease will also kill them. Köllar recommends tobacco water, or the internal use of flour of brimstone or sulphur. Brine, coal oil, benzine, camphor and new rum, and *coculus indicus*, one ounce to a gallon of water, have been recommended. Mercurial ointments will kill the lice, but being active poisons should not be put on any part of the animal where they can be licked off by itself or by other cattle.

DIPTERA.

This order includes insects possessing only two wings. Most of them undergo a complete metamorphosis. First, the maggot emerges from the egg; it then changes into either a naked pupa, or the pupa is found in the dried-up skin of the larva, the skin forming a puparium or hard, shelly covering, completely protecting the pupa within. In this state they take no nourishment, and are incapable of locomotion. The perfect insect is furnished with two wings and a piercer, or trunk, for piercing or sucking. The larva of the common mosquito lives in water, and may be seen any summer day swimming in pools of stagnant water or in rain-water reservoirs in the form of small tadpole-like insects. Rain-water casks, unless tightly covered, serve as nurseries for millions of mosquitoes. We have known a room to swarm with them from a single bucket of water which had been accidentally left in a bed-room for several days. A little oil poured on the water in a cask or reservoir destroys the larvæ; as they have to come to the surface for breathing, the oil closes their organs of respiration.

The eggs of the Hessian fly are deposited in longitudinal creases in the blade of the wheat-plant in autumn and spring. These eggs hatch in from four to

twenty days, according to the weather; the larvæ crawl down, working their way between the leaf and the main stalk till they come to a joint, where they remain and suck the sap, and attain their full growth in from four to six weeks. The pupa is formed in the same place; its outer covering or puparium resembling a flax-seed. The insects appear in April or May, and lay their eggs in wheat, barley, rye, &c. Curtis says that feeding the wheat off with sheep might possibly save the crop from the Hessian fly. Dr. Harris recommends the same as a partial remedy. Mr. Herrick states that the stouter varieties of wheat should be chosen and the land kept in good condition. If fall wheat is sown late, some eggs will be avoided, but the risk of winter-killing will be incurred. Great numbers of the pupæ may be destroyed by burning the stubble immediately after harvest, and then ploughing and harrowing the land; steeping the grain and then rolling it in plaster or lime tends to promote a vigorous growth, and is therefore beneficial. Sowing the fields with wood ashes, two bushels to an acre, in autumn, and again the first and last weeks in April, and as late in May as the wheat can be passed over without injury, has been found useful. It is recommended to procure fresh seed from localities not infested by the insect.

The larvæ of the wheat midge are frequently miscalled the weevil or red weevil; they are very destructive to wheat, barley, rye and grass. The eggs are deposited in June and July in the opening flowers of the grain, two to fifteen in each grain. These hatch in about eight days, and produce minute orange-colored grubs which feed upon the grain when in a milky state, inside the chaff or outer covering, or upon the pollen of the flower. When fully grown, the larvæ descend and burrow in the earth, where they remain all winter. The pupæ are formed in the ground in May or June; the perfect fly or midge then comes forth and deposits its eggs on the grain and grass. Dr. Fitch says that late sowing is one of the most easy and successful expedients. Dr. Harris states that "fumigation by burning strips of woollen cloth dipped in melted brimstone to the windward side of the field at the time the grain is in bloom proves very offensive to the flies when depositing their eggs;" but some farmers who have tried it say it is of no practical benefit. Lime or ashes strewn over the grain when in blossom and wet with dew will be useful; newly slacked lime and good wood ashes will be required, and from a peck to a bushel to the acre. When the maggots have left the grain and are in the ground, ploughing is recommended as soon as the grain is harvested, and perhaps thoroughly liming the soil before ploughing might aid in the destruction of the insects. The chaff and refuse straw containing maggots should be burned. Early sowing in the autumn or late in the spring will enable the wheat to become too far advanced and hard before the fly makes its appearance in the first case, and by not coming into blossom in the last until the flies have disappeared. In Massachusetts, wheat sown after the 15th or 20th of May generally escapes the ravages of the midge. Dr. Fitch states that in 1854 this insect caused a loss in the State of New York alone of over $15,000,000. It has been suggested not to sow wheat on the same field; but Dr. Fitch thinks it of no use to try to starve the midge by depriving it of wheat for a year or two, as it would probably feed upon grasses and return to its favorite food when wheat is cultivated again. He likewise says that the flies or midges cannot breathe a warm, dry atmonphere, and that hence we learn that if the last half of June is unusually dry the wheat escapes injury, but if wet and showery it is likely to suffer severely. Yellow birds, it is said, devour the larvæ in the fields. Burning the stubble will not effect the insect, as it burrows in the earth to change to the pupa. They multiply rapidly, and as yet no parasite has been discovered in this country to destroy or keep them in check. Myriads of the flies can be caught by sweeping the fields with a bag net. In badly infested districts it would be well to plough the fields deeply in the spring, burying crop, larvæ and all, so as to prevent the reappearance of the insect. A cer-

tain Lambert wheat was mentioned in 1862 as being midge proof, but hearing nothing more of it we presume it has proved vulnerable.

Fleas may be driven from barns and hogsties by scattering quick-lime about those places. House flies, being bred in filth and manure, may be prevented from multiplying about houses by keeping the premises clean. Carrion flies often deposit their eggs in the wounds or sores of sheep and cattle; to prevent this applications of tar or turpentine are used. Gadflies and horse flies may be driven from horses, it is said by decoctions of walnut leaves; sometimes lobelia or aloes are added to the wash.

The eggs of the onion fly are laid on the leaves close to the earth; the larvæ when hatched eat their way into the heart of the onion and attain their full growth in about two weeks. The pupa is formed in the onion and the perfect insect appears in two or three weeks. Dr. Harris advises sowing the seed on ground where a quantity of straw has been burned. Mr. Bartlett suggests hot water poured through a small tube along the drills near the roots of the plants; it seems very probable, however, that by this remedy the onions would be cooked as well as the maggots. Tar and water, wood ashes, lime, powdered charcoal, flour of sulphur and other substances have been recommended. The charcoal seems to be most approved. Mr. Sanborn advises petroleum sprinkled along the rows, or watering with soap-suds and soot or pyroligneous acid. For a fly of similar habits destructive to the carrot Curtis recommends suds and gas water or gas tar to prevent the fly from depositing her eggs, and a dressing of lime and salt to kill the maggots. All infested onions should be at once destroyed to prevent the insect escaping and depositing her eggs on others.

The larvæ of the stomach bot flies are very troublesome to horses kept in open fields. The eggs are deposited on the hair of a horse and swallowed with his food after being licked or bitten off. The larvæ or true bot worms then fasten themselves by means of hooks at the anterior extremity in clusters on the inside of the stomach, and when fully grown are voided in the excrement of the animal where they change into pupæ from which the perfect fly is produced that lays the eggs. Dr Harris says that "no sure and safe remedy has yet been found for removing the bots from the stomach. The only treatment is copious bleeding and a free use of mild oils in the early stages of the attack. The preventives are very simple, such as scraping or washing off the eggs or nits from the hairs every day." It is said that molasses and milk taken by the horse will cause the bot to leave its hold to feed upon that, and a powerful purgative being given, the animal will eject the bot before it has time to refasten itself to the stomach. Bleeding the horse in the mouth or nose, and causing him to swallow the blood, is said to have the same effect, Entrails of chicken and pieces of raw flesh have also been used; some farmers recommend the use of salt or brine in the horse's food once a week.

The grubs or larvæ of the skin-bot flies may be extracted by pressing on each side of the tumor; sometimes cutting the skin may be necessary. The grub in the head of sheep may be destroyed by an injection of animal oil, diluted with water. Whale oil put up the nostrils with a feather is said to be beneficial; whiskey, Scotch snuff, tobacco and warm water, tarring noses, and various other remedies are resorted to; but if left alone, the worms will leave of themselves in the spring.

Ticks on sheep may be destroyed by various arsenical preparations, but, being poisonous, they are not always safe. Decoctions of tobacco, applications of oil, brimstone, lard, paraffine oil, &c., about the neck, are highly spoken of.

The scab on sheep is said to be caused by an acarus, or mite, and though the acari do not properly belong to the true insects, some of them are exceedingly injurious to plants and animals. A wash for scab is made of one pound tobacco boiled in four gallons water, with four gallons lime water, and one pint turpentine

added afterwards. The itch on mankind is caused by an acarus, and a wash is advised of one part quicklime, two parts sulphur, and ten parts water.

The red spider, so troublesome in greenhouses, is also a mite. Mr. Saunders uses one peck unslacked lime and one pound sulphur slacked together so as to boil, and then mixed with water and allowed to stand. The liquid is sprinkled over the plants with a watering pot, or syringe; this is also a remedy for mildew, and is useful in driving bugs from squash and cucumber vines. If greenhouses and all the wood-work in them are covered with whitewash, to which some of this mixture is added, the fungoid mildew and insect depredators will be much less troublesome.

Many remedies for injurious insects, recommended by agricultural journals, are of no utility whatever. Some may prove useful, and should be experimented upon by practical farmers and reported to the Department of Agriculture, as it is only from the experience of such men that we can learn what is of real benefit. The naturalist, studying the habits and instincts of injurious insects, may suggest remedies, but it remains to the farmer to aid him by making known the results. Of the suggestions made in this paper, some of them are good, some probably indifferent, and some may be bad, as injurious to plants, as well as to the insects. We hope, by a system of interchange of knowledge with practical farmers, to be able hereafter to sift the really beneficial from the useless; and that the latter, being proved and condemned, will not reappear periodically in print in local papers, and in a new guise, as valuable discoveries, be copied into standard agricultural works.

TOWNEND GLOVER.

Hon. ISAAC NEWTON,
Commissioner of Agriculture.

REPORT OF AGRICULTURAL STATISTICS

For the year 1864 *as to crops, for* 1864–5 *as to farm stock, and for* 1864 *and six months of* 1865 *as to miscellaneous statistics.*

LETTER OF THE STATISTICIAN TO THE COMMISSIONER OF AGRICULTURE.

DEPARTMENT OF AGRICULTURE,
Washington, August, 1865.

SIR: The following report from the statistical division of your department exhibits the statistics procured during the past and in the beginning of the present year of the crops and of the farm stock of 1864 of the loyal States; of the condition of our foreign trade for several years; that of the national debt on the 31st day of July, 1865; of the revenues of the government derived in 1864 from customs, internal and income taxes, and other miscellaneous matters of interest to the agriculturists of the country.

Although some of these statistics are financial and commercial, rather than agricultural, yet they should not be separated, for the present mode of raising the revenues of the government gives rise to legislation affecting the interests of the farmer, and the statistics showing the operation of laws should not be withheld from him.

The farmer, too, is interested in the foreign trade of the country, for however small the amount of the exports of agricultural produce when compared with the amount consumed at home, and however insignificant is our foreign commerce when contrasted with the internal commerce, yet, as it is this foreign

trade that relieves the home markets from the surplus production which would weigh down domestic prices, and thereby fixes the standard of home values, it must ever be regarded with an anxious interest by every agriculturist.

LEWIS BOLLMAN, *Statistician.*

Hon. ISAAC NEWTON, *Commissioner.*

EXPLANATION OF THE ANSWERS TO QUESTIONS IN THE FOLLOWING TABLES WHEN GIVEN IN TENTHS.

Nearly all the answers to questions asked of the correspondents relative to crops and farm stock are given in *tenths*. In order that these may be understood we give an explanation of the system adopted in this correspondence.

It required but a brief experience to show that correspondents could not state the amount of a crop in bushels, pounds, or tons. But from the conversation of farmers generally in a neighborhood, and at the county seats, especially when aided by observing farmers in different localities, the correspondent could very accurately determine whether a crop was larger or smaller than that of the preceding year, and whether one, two, five, or other number of *tenths* larger or smaller. Hence the number 10 was chosen to represent the crop of the last year, for it allowed sufficient scope below it to state with sufficient accuracy as great a decrease as any crop could be subject to without being wholly destroyed. If a crop is regarded as *one-tenth better* than last year's, the answer is stated to be 11, and if *one-tenth worse* it is written 9. And in this way for any number of tenths better or worse. So as to *appearance* of the crop or *injuries* to it. The figures 10 represent an *average appearance* and an *average injury*.

The *numbers* of farm stock are stated in the same manner, as well as their *condition.*

The circulars are sent to correspondents monthly, and returned on a *stated* day. The answers are transferred to rolls for each State, and the *average* for a State is ascertained by adding the *tenths* for the counties and dividing the sum of all by the number of counties making a return for each crop or kind of stock.

The first circulars called for a comparison with the crop of 1859, as reported in bushels, pounds, or tons by the census of 1860, and, taking this as the *base*, the *amount* of the crop of 1862 was thus ascertained. From this amount that of 1863 was estimated, and so for each year the crop will be estimated on the base of the amount of the crop of the preceding year.

The *importance* of a complete and correctly taken census has thus been made vastly greater than it assumed heretofore, although highly important at all times.

TABLE No. 1—THE CROPS FOR 1864.

The tables of these crops are divided as follows:

A. Showing the questions asked the correspondents of the department in the several counties, and a general average of these counties for each State of the answers returned.

B. Exhibiting the amount of each crop for 1864 for each of the States named, as estimated from the preceding table, (A,) the yield per acre of each crop in each State, the number of acres in each crop, the value per bushel, pound, or ton, and the total value.

C. Summary for each State of the amount, the number of acres, and the value of each crop in 1864.

D. A more general summary showing the amount, acreage, value, and comparison of the crops of 1863 and 1864.

A—*Table showing the condition of the crops compared with* 1863.

STATES.	WHEAT. Av'ge am't of crop compared with 1863, in tenths.	WHEAT. Average yield per acre in 1864, stated in bushels.	WHEAT. Average price per bushel on 1st of January, 1865.	RYE. Av'ge am't of crop compared with 1863, in tenths.	RYE. Average yield per acre in 1864, stated in bushels.	RYE. Average price per bushel on 1st of January, 1865.	BARLEY. Av'ge am't of crop compared with 1863, in tenths.	BARLEY. Average yield per acre in 1864, stated in bushels.	BARLEY. Average price per bushel on 1st of January, 1865.
Maine	7 3/4	10 5/11	$2 60	7 3/4	12	$2 04 1/2	6 2/3	18	$1 45
New Hampshire	9 6/7	12 1/2	2 68	7 1/2	14 1/3	2 04	7 1/7	18	1 69
Vermont	11	14	2 57 1/2	10 3/4	15 1/6	1 88	10	22	1 61
Massachusetts	9 7/8	16	2 41	10 4/6	15	2 00	9 6/7	20	1 78
Rhode Island	10	15	2 50	11	17	2 00	9	25	1 64
Connecticut	12	16 1/2	2 37 1/2	11 2/3	15	1 91	9	23 1/2	1 81
New York	8 5/13	13	2 34 3/8	9 3/8	14 1/2	1 70 1/2	7 3/5	18 3/4	1 74 1/8
New Jersey	8 8/10	15	2 33	9 1/2	13 1/2	1 69 1/2	10	20	1 78 1/2
Pennsylvania	8	12	2 40	10	14 1/4	1 70 1/6	11	18	1 71
Maryland	9	11 1/3	2 60	9 3/8	14	1 64	13 1/2	26 2/3	1 78 3/4
Delaware	8 1/3	12	2 53	11	15 3/8	1 56 2/3	9	27	1 87 1/2
Kentucky	7	10 1/4	1 96 1/2	7	13 3/8	1 35 1/3	8 1/2	23 1/3	1 59 1/6
Ohio	7 1/4	10 1/4	1 93	8 1/6	12 1/4	1 32 1/6	11 1/3	23 3/8	1 56
Michigan	10	12	1 96	8 4/5	12 1/4	1 36 1/3	8 1/5	19 1/5	1 56
Indiana	11	14	1 75	9 3/8	14	1 31	10 9/10	24	1 56
Illinois	10 5/8	14 1/3	1 55	9 5/8	15	1 01 1/2	9 1/2	22 1/3	1 37
Missouri	11 1/2	14 1/5	1 75	10 4/5	15 3/8	1 11 1/8	9 1/2	23	1 47 3/8
Wisconsin	6 1/3	9 1/3	1 48 1/8	8	12 1/4	1 09 1/6	7 1/7	13 1/4	1 49
Iowa	10	12 1/4	1 34 1/2	9 3/4	15	92	9 3/4	21	1 20 1/4
Minnesota	10	13 1/8	1 13 3/8	9	14 1/8	92	9 1/2	20	1 09 1/6
Kansas	7 7/10	15	2 01	7 5/6	17	1 25	10 5/6	23	1 27
West Virginia	6 1/4	9 1/4	2 01	10 1/2	12 1/3	1 47	9	20 1/2	1 67
Nebraska Territory	7	14	1 50	8	16	1 29	8 1/2	20	1 22 1/2

A—*Table showing the condition of the crops, &c.*—Continued.

STATES.	OATS. Av'ge am't of crop compared with 1863, in tenths.	OATS. Average yield per acre in 1864, stated in bushels.	OATS. Average price per bushel on 1st of January, 1865.	CORN. Av'ge am't of crop compared with 1863, in tenths.	CORN. Average yield per acre in 1864, stated in bushels.	CORN. Average price per bushel on 1st of January, 1865.	TOBACCO. Av'ge am't of crop compared with 1863, in tenths.	TOBACCO. Average yield per acre in 1864, stated in pounds.	TOBACCO. Average price per pound on 1st of January, 1865.
Maine	6 2/11	22	$1 01	7 4/7	27	$2 10	......	......	......
New Hampshire	8 1/7	24	92	8	29 1/2	2 11	12 4/5	985	$0 25
Vermont	9 1/7	33	87	10	38 4/5	1 96	14 4/6	......	......
Massachusetts	9	26 3/10	1 04	9 1/4	31 1/2	2 04	13	1,650	25
Rhode Island	9	33	98 3/4	10 1/8	30 1/4	2 09	11	1,350	30
Connecticut	11 2/3	30	1 00	10	31	1 81	13 1/5	1,450	25
New York	8 1/8	23	94	9 2/5	29 1/8	1 68	12 4/5	856	24 7/8
New Jersey	11 7/10	32 1/2	91 1/7	8 4/9	31 3/8	1 70 1/7	9 1/4	......	25
Pennsylvania	11	29 1/4	87	9 1/4	29 1/2	1 54 3/4	11	1,068 1/2	18 1/2
Maryland	13 2/7	22	87	7 1/4	21 1/2	1 62	6 5/6	750	13 3/8
Delaware	12	24	80	10	20 1/8	1 55	9	......	......
Kentucky	12 1/6	24 1/4	79 1/4	7 7/8	28 1/2	96 3/8	5	770	12
Ohio	12	29	72 1/5	9 1/3	31 1/8	96	10 1/8	870 1/2	13 1/2

A—*Table showing the condition of the crops, &c.*—Continued

STATES.	OATS.			CORN.			TOBACCO.		
	Av'ge am't of crop compared with 1863, in tenths.	Average yield per acre in 1864, stated in bushels.	Average price per bushel on 1st of January, 1865.	Av'ge am't of crop compared with 1863, in tenths.	Average yield per acre in 1864, stated in bushels.	Average price per bushel on 1st of January, 1865.	Av'ge am't of crop compared with 1863, in tenths.	Average yield per acre in 1864, stated in pounds.	Average price per pound on 1st of January, 1865.
Michigan	$8\frac{6}{7}$	26	\$0 $75\frac{3}{4}$	$7\frac{1}{8}$	$24\frac{1}{8}$	\$1 26	12	1,000	20
Indiana	11	26	$73\frac{3}{5}$	8	29	$95\frac{1}{2}$	$8\frac{5}{12}$	$856\frac{1}{8}$	14
Illinois	$12\frac{1}{8}$	$31\frac{1}{6}$	61	10	33	75	$9\frac{1}{4}$	907	$16\frac{1}{7}$
Missouri	10	$25\frac{1}{4}$	$71\frac{1}{2}$	$6\frac{7}{10}$	$26\frac{4}{5}$	97	$4\frac{4}{5}$	$562\frac{1}{2}$	$13\frac{4}{7}$
Wisconsin	$8\frac{1}{8}$	$27\frac{1}{2}$	60	10	31	94	$9\frac{3}{8}$	980	15
Iowa	12	32	53	$11\frac{1}{5}$	$36\frac{3}{8}$	$67\frac{5}{8}$	12	957	25
Minnesota	12	$28\frac{3}{4}$	$73\frac{1}{2}$	$11\frac{3}{8}$	33	94	8	800	20
Kansas	$12\frac{4}{7}$	29	$96\frac{1}{2}$	$7\frac{4}{9}$	25	1 37	$8\frac{1}{5}$	675	$11\frac{1}{2}$
West Virginia	13	24	$79\frac{1}{2}$	$11\frac{1}{8}$	31	1 06	$10\frac{1}{4}$	$655\frac{1}{2}$	20
Nebraska Territory	$8\frac{1}{8}$	28	$68\frac{1}{8}$	$7\frac{1}{8}$	$28\frac{1}{2}$	99	6	......	......

A—*Table showing the condition of the crops, &c.*—Continued.

STATES.	BUCKWHEAT.			POTATOES.			HAY.		
	Av'ge am't of crop compared with 1862, in tenths.	Average yield per acre in 1864, stated in bushels.	Average price per bushel on 1st of January, 1865.	Av'ge am't of crop compared with 1862, in tenths.	Average yield per acre in 1864, stated in bushels.	Average price per bushel on 1st of January, 1865.	Av'ge am't of hay compared with 1863, in tenths.	Average yield per acre in 1864, stated in tons.	Average price per ton on 1st of January, 1865.
Maine	$7\frac{3}{4}$	19	\$1 28	$9\frac{3}{8}$	143	\$0 67	$9\frac{3}{11}$	$\frac{7}{8}$	\$21 00
New Hampshire	$8\frac{5}{6}$	$19\frac{1}{6}$	1 32	$9\frac{2}{7}$	164	60	9	1	21 00
Vermont	9	$19\frac{2}{9}$	1 04	$11\frac{1}{2}$	$162\frac{1}{2}$	54	$8\frac{5}{8}$	1	17 95
Massachusetts	9	$16\frac{1}{4}$	1 25	$10\frac{4}{7}$	$132\frac{1}{4}$	93	$8\frac{3}{8}$	1	29 00
Rhode Island	8	......	....	$9\frac{3}{8}$	$127\frac{1}{2}$	$97\frac{1}{2}$	$7\frac{1}{2}$	1	31 50
Connecticut	$11\frac{3}{5}$	$16\frac{3}{5}$	1 35	10	131	83	8	$1\frac{1}{6}$	27 00
New York	$9\frac{1}{2}$	$18\frac{1}{9}$	1 $13\frac{3}{8}$	9	$115\frac{1}{8}$	66	8	$1\frac{2}{19}$	23 05
New Jersey	$8\frac{3}{4}$	17	1 44	$8\frac{1}{2}$	$86\frac{3}{8}$	1 08	$10\frac{3}{10}$	$1\frac{4}{7}$	26 $71\frac{1}{7}$
Pennsylvania	$11\frac{1}{8}$	$18\frac{3}{4}$	1 $16\frac{3}{4}$	$8\frac{3}{8}$	$110\frac{1}{8}$	89	10	$1\frac{3}{10}$	24 55
Maryland	$7\frac{4}{5}$	$19\frac{3}{5}$	1 58	7	55	1 20	$10\frac{3}{4}$	$1\frac{1}{3}$	27 00
Delaware	$8\frac{1}{2}$	20	1 00	$8\frac{3}{8}$	125	1 32	$10\frac{1}{8}$	$1\frac{1}{2}$	30 00
Kentucky	10	$20\frac{1}{8}$	1 $37\frac{1}{2}$	$8\frac{3}{8}$	$81\frac{1}{6}$	1 $09\frac{3}{8}$	$10\frac{1}{2}$	$1\frac{1}{3}$	20 16
Ohio	11	17	1 10	9	96	$91\frac{1}{4}$	$10\frac{1}{2}$	$1\frac{1}{8}$	19 38
Michigan	$9\frac{1}{7}$	12	1 $18\frac{1}{2}$	$6\frac{1}{2}$	79	$81\frac{1}{2}$	8	$1\frac{1}{19}$	19 33
Indiana	$7\frac{3}{5}$	$18\frac{1}{2}$	1 $24\frac{1}{8}$	$6\frac{3}{8}$	80	$99\frac{1}{2}$	$10\frac{1}{8}$	$1\frac{1}{2}$	17 81
Illinois	$6\frac{1}{2}$	17	1 10	7	$81\frac{1}{4}$	1 15	$10\frac{1}{2}$	$1\frac{1}{2}$	15 33
Missouri	$5\frac{2}{7}$	$16\frac{5}{7}$	1 07	$5\frac{1}{5}$	39	1 $75\frac{1}{3}$	$12\frac{2}{10}$	$1\frac{3}{7}$	18 $12\frac{1}{2}$
Wisconsin	$8\frac{3}{8}$	$16\frac{1}{2}$	$88\frac{3}{4}$	$7\frac{3}{7}$	118	55	$7\frac{7}{16}$	$1\frac{1}{7}$	13 00
Iowa	10	$17\frac{1}{2}$	1 14	7	76	1 $11\frac{1}{3}$	12	$1\frac{5}{8}$	9 51
Minnesota	$9\frac{1}{6}$	$17\frac{3}{8}$	1 $23\frac{1}{3}$	8	112	$67\frac{1}{7}$	$9\frac{5}{7}$	$1\frac{1}{2}$	9 36
Kansas	$5\frac{1}{2}$	15	1 25	$5\frac{2}{9}$	43	2 68	10	$1\frac{3}{8}$	13 00
West Virginia	$10\frac{3}{8}$	$18\frac{1}{3}$	1 32	$10\frac{3}{8}$	74	1 29	$11\frac{4}{7}$	$1\frac{1}{2}$	20 61
Nebraska Territory	......	......	....	$3\frac{3}{4}$	$51\frac{3}{8}$	2 08	8	$1\frac{1}{3}$	7 33

TABLE B,

Showing the amount in bushels, &c., of each principal crop of the several States named, the yield per acre, the total acreage, the average price in each State, and the value of each crop, for 1864.

Products.	Amount of crop of 1864.	Average yield per acre.	Number of acres in each crop.	Value per bushel, pound, &c.	Total valuation.
MAINE.					
Indian corn ....bushels..	1,410,017	27	52,223	$2 10	$2,961,036
Wheat ....do....	167,194	10 5/11	15,999	2 60	434,704
Rye..................do....	128,612	12	10,718	2 04½	263,012
Oats ....do....	2,102,994	22	95,591	1 01	2,124,024
Barley ....do....	668,424	18	37,135	1 45	970,215
Buckwheat ....do....	350,837	19	18,465	1 28	449,071
Potatoes ....do....	7,189,151	143	50,274	67	4,816,731
Tobacco ....pounds..	....	....	....	....	....
Hay ....tons...	1,085,705	⅞	1,240,806	21 00	22,799 805
Total..............	....	....	1,521,211	....	34,818,598
NEW HAMPSHIRE.					
Indian corn ....bushels..	1,334,628	29½	45,242	2 11	2,816,065
Wheat ....do....	251,518	12½	20,121	2 68	674,068
Rye ....do....	109,373	14½	7,543	2 04	223,121
Oats ....do....	1,095,891	24	45,662	92	1,008,220
Barley ....do....	96,278	18	5,349	1 69	162,710
Buckwheat ....do....	87,447	19⅙	4,564	1 32	115,430
Potatoes ....do....	3,842,154	164	23,427	60	2,305,292
Tobacco ....pounds..	64,000	985	65	25	16,000
Hay ....tons...	694,161	1	694,161	21 00	14,577,381
Total..............	....	....	846,134	....	21,898,287
VERMONT.					
Indian corn ....bushels..	1,585,020	38⅘	40,851	1 96	3,106,639
Wheat ....do....	497,951	14	35,568	2 57½	1,282,224
Rye ....do....	140,798	15⅕	9,263	1 88	264,700
Oats ....do....	3,611,938	33	109,452	87	3,142,386
Barley ....do....	94,102	22	4,277	1 61	151,504
Buckwheat ....do....	210,516	19 2/9	10,954	1 04	218,937
Potatoes ....do....	5,920,810	162½	36,434	54	3,197,237
Tobacco...........pounds..	59,000	....	....	....	....
Hay ....tons...	850,127	1	850,127	17 95	15,259,780
Total..............	....	....	1,096,926	....	26,623,407
MASSACHUSETTS.					
Indian corn ....bushels..	2,280,324	31½	72,319	2 04	4,651,861
Wheat ....do....	128,143	16	8,009	2 41	308,825
Rye ....do....	413,957	15	27,597	2 00	827,914
Oats ....do....	1,194,827	26 3/10	45,430	1 04	1,242,620
Barley ....do....	149,584	20	7,479	1 78	266,260
Buckwheat ....do....	110,972	16¼	6,829	1 25	138,715
Potatoes ....do....	3,384,878	132½	25,546	93	3,147,937
Tobacco ....pounds..	6,760,000	1,650	4,097	25	1,690,000
Hay ....tons...	760,517	1	760,517	29 00	22,054,993
Total..............	....	....	957,823	....	34,329,125

TABLE B—Continued.

Products.	Amount of crop of 1864.	Average yield per acre.	Number of acres in each crop.	Value per bushel, pound, &c.	Total valuation.
RHODE ISLAND.					
Indian corn ....bushels..	474,208	$30\frac{1}{4}$	15,676	$2 09	$991,095
Wheat ....do....	1,413	15	94	2 50	3,532
Rye......................do....	37,302	17	2,194	2 00	74,604
Oats.....................do....	182,873	33	5,542	$98\frac{3}{4}$	180,587
Barley ....do....	41,506	25	1,660	1 64	68,070
Buckwheat ....do....	3,097	....	....	....	....
Potatoes ....do....	525,727	$127\frac{1}{2}$	4,123	$97\frac{1}{2}$	512,584
Tobacco ....pounds..	1,848	1,350	$1\frac{37}{100}$	30	545
Hay ....tons...	62,044	1	62,044	31 50	1,954,386
Total..................	....	....	$91,334\frac{37}{100}$	....	3,785,403
CONNECTICUT.					
Indian corn ....bushels..	2,059,835	31	66,446	1 81	3,728,301
Wheat ....do....	71,881	$16\frac{1}{2}$	4,356	2 $37\frac{1}{2}$	170,717
Rye......................do....	721,889	15	48,126	1 91	1,378,808
Oats.....................do....	2,011,334	30	67,044	1 00	2,011,334
Barley ....do....	18,732	$23\frac{1}{2}$	797	1 81	33,905
Buckwheat ....do....	387,477	$16\frac{3}{5}$	23,342	1 35	523,094
Potatoes ....do....	1,833,148	131	13,993	83	1,521,513
Tobacco ....pounds..	9,900,218	1,450	6,828	25	2,475,054
Hay ....tons...	449,956	$1\frac{1}{5}$	374,963	27 00	12,148,812
Total..................	....	....	605,895	....	23,991,538
NEW YORK.					
Indian corn ....bushels..	22,628,862	$29\frac{1}{3}$	771,526	1 68	38,016,488
Wheat ....do....	10,918,615	13	839,893	2 $34\frac{5}{8}$	25,622,350
Rye......................do....	5,205,759	$14\frac{1}{2}$	359,018	1 $70\frac{1}{2}$	8,875,819
Oats.....................do....	35,724,746	23	1,553,250	94	33,581,261
Barley ....do....	3,710,911	$18\frac{3}{4}$	197,915	1 $74\frac{1}{3}$	6,469,355
Buckwheat ....do....	5,677,490	$18\frac{1}{9}$	313,488	1 $13\frac{2}{3}$	6,453,414
Potatoes ....do....	29,753,312	$115\frac{1}{3}$	257,984	66	19,637,186
Tobacco ....pounds..	12,912,662	856	15,085	$24\frac{7}{8}$	3,212,025
Hay ....tons...	3,921,264	$1\frac{2}{19}$	3,547,810	23 05	90,385,135
Total..................	....	....	7,855,969	....	232,253,033
NEW JERSEY.					
Indian corn ....bushels..	8,464,262	$31\frac{2}{3}$	267,349	1 $70\frac{1}{7}$	14,401,337
Wheat ....do....	1,582,113	15	105,474	2 33	3,686,323
Rye......................do....	1,424,523	$13\frac{1}{2}$	105,520	1 $69\frac{1}{2}$	2,414,566
Oats.....................do....	5,735,647	$32\frac{1}{2}$	176,481	$91\frac{1}{7}$	5,227,640
Barley ....do....	29,098	20	1,454	1 $78\frac{1}{2}$	51,940
Buckwheat ....do....	921,256	17	54,191	1 44	1,326,609
Potatoes ....do....	3,989,179	$86\frac{2}{3}$	46,033	1 08	4,308,313
Tobacco ....pounds..	179,755	....	....	25	44,939
Hay ....tons...	436,496	$1\frac{4}{7}$	277,770	26 $71\frac{1}{2}$	11,660,991
Total..................	....	....	1,034,272	....	43,122,658

TABLE B—Continued.

Products.	Amount of crop of 1864.	Average yield per acre.	Number of acres in each crop.	Value per bushel, pound, &c.	Total valuation.
PENNSYLVANIA.					
Indian corn ....bushels..	28,381,685	29½	962,091	$1 54¾	$43,920,658
Wheat ....do....	12,523,404	12	1,043,617	2 40	30,056,170
Rye..................do....	6,843,427	14¼	480,240	1 70⅙	11,645,232
Oats ....do....	37,657,329	29¼	1,287,430	87	32,761,876
Barley ....do....	630,491	18	35,027	1 71	1,078,140
Buckwheat ....do....	7,577,955	18¾	404,157	1 16¾	8,847,262
Potatoes ....do....	12,661,424	110⅓	114,759	89	11,268,667
Tobacco ....pounds..	6,124,551	1,068½	5,732	18½	1,133,042
Hay ....tons...	1,796,336	1 3/10	1,381,797	24 55	44,100,049
Total..............	....	....	5,714,850	....	184,811,096
MARYLAND.					
Indian corn ....bushels..	10,509,243	21½	488,802	1 62	17,024,974
Wheat ....do....	6,487,946	11½	564,178	2 60	16,868,660
Rye..................do....	529,744	14	37,838	1 64	868,780
Oats ....do....	5,429,894	22	246,813	87	4,724,008
Barley ....do....	26,591	26⅔	997	1 78⅔	47,509
Buckwheat ....do....	189,285	19⅗	9,657	1 58	299,070
Potatoes ....do....	1,061,994	55	19,309	1 20	1,274,393
Tobacco ....pounds..	33,292,968	750	44,391	13⅔	4,550,039
Hay ....tons...	167,909	1⅓	125,931	27 00	4,533,543
Total..............	....	....	1,537,916	....	50,190,976
DELAWARE.					
Indian corn ....bushels..	3,892,337	20⅓	191,458	1 55	6,033,122
Wheat ....do....	1,054,954	12	87,912	2 53	2,668,834
Rye ....do....	41,153	15⅔	2,627	1 56⅔	64,473
Oats ....do....	1,184,437	24	49,351	80	947,550
Barley ....do....	4,595	27	170	1 87½	8,616
Buckwheat ....do....	15,641	20	782	1 00	15,641
Potatoes ....do....	327,540	125	2,620	1 32	432,353
Tobacco ....pounds..	14,057	....	....	....	....
Hay ....tons...	33,111	1½	22,074	30 00	993,330
Total..............	....	....	311,994	....	11,163,919
KENTUCKY.					
Indian corn ....bushels..	42,828,706	28½	1,502,761	96⅔	41,399,749
Wheat ....do....	3,882,275	10¼	378,758	1 96½	7,628,670
Rye ....do....	554,014	13⅖	41,344	1 35½	750,689
Oats ....do....	4,346,326	24¼	179,229	79¼	3,444,463
Barley ....do....	172,563	23⅓	7,503	1 59⅙	274,663
Buckwheat ....do....	14,187	20⅓	698	1 37½	19,507
Potatoes ....do....	1,255,921	81⅙	15,474	1 09⅔	1,377,327
Tobacco ....pounds..	56,956,469	770	73,969½	12	6,834,776
Hay ....tons...	112,325	1⅓	84,243	20 16	2,264,472
Total..............	....	....	2,283,982	....	63,994,316

TABLE B—Continued.

Products.	Amount of crop of 1864.	Average yield per acre.	Number of acres in each crop.	Value per bushel, pound, &c.	Total valuation.
OHIO.					
Indian corn ....bushels..	68,202,641	31⅓	2,176,911	$0 96	$65,474,535
Wheat ....do....	20,407,503	10¼	1,990,976	1 93	39,386,481
Rye ....do....	704,974	12¼	57,548	1 32⅙	931,741
Oats ....do....	14,428,833	29	497,546	72⅕	10,417,617
Barley ....do....	1,585,630	23⅔	67,016	1 56	2,473,583
Buckwheat ....do....	1,300,141	17	76,479	1 10	1,430,155
Potatoes ....do....	4,615,881	96	48,082	91¼	4,211,991
Tobacco ....pounds..	29,017,931	870½	33,335	13½	3,917,421
Hay ....tons...	1,415,096	1⅓	1,061,322	19 38	27,424,560
Total................	....	....	6,009,215	....	145,668,084
MICHIGAN.					
Indian corn ....bushels..	11,088,801	24⅓	455,766	1 26	13,971,889
Wheat ....do....	13,966,153	12	1,163,846	1 96	27,373,660
Rye ....do....	434,894	12¼	35,419	1 36⅓	592,905
Oats ....do....	4,810,136	26	185,005	75¾	3,643,678
Barley ....do....	338,388	19⅕	17,624	1 56	527,885
Buckwheat ....do....	823,453	12	68,620	1 18½	975,792
Potatoes ....do....	3,422,078	79	43,317	81½	2,788,994
Tobacco ....pounds..	248,473	1,000	248	20	49,695
Hay ....tons...	847,737	1⅑	762,963	19 33	16,386,756
Total................	....	....	2,732,808	....	66,311,254
INDIANA.					
Indian corn ....bushels..	74,284,363	29	2,561,529	95½	70,941,567
Wheat ....do....	22,321,376	14	1,594,384	1 75	39,062,308
Rye ....do....	397,632	14	28,402	1 31	520,898
Oats ....do....	6,084,793	26	234,030	73⅗	4,478,408
Barley ....do....	339,198	24	14,133	1 56	529,149
Buckwheat ....do....	272,171	18½	14,712	1 24⅓	338,399
Potatoes ....do....	2,904,847	80	36,310	99½	2,890,323
Tobacco ....pounds..	8,767,065	856	10,241	14	1,227,389
Hay ....tons...	962,805	1½	641,870	17 81	17,147,557
Total................	....	....	5,135,611	....	137,135,998
ILLINOIS.					
Indian corn ....bushels..	138,356,135	33	4,192,610	75	103,767,101
Wheat ....do....	33,371,173	14⅓	2,328,763	1 55	51,725,318
Rye ....do....	850,071	15	56,671	1 01½	862,822
Oats ....do....	24,273,751	31⅙	779,003	61	14,806,988
Barley ....do....	1,144,790	22⅔	50,520	1 37	1,568,362
Buckwheat ....do....	280,370	17	16,492	1 10	308,407
Potatoes ....do....	4,511,083	81¼	55,521	1 15	5,187,745
Tobacco ....pounds..	18,867,722	907	20,802	16⅐	3,045,789
Hay ....tons...	2,166,725	1½	1,444,483	15 33	33,215,894
Total................	....	....	8,944,865	....	214,488,426

TABLE B—Continued.

Products.	Amount of crop of 1864.	Average yield per acre.	Number of acres in each crop.	Value per bushel, pound, &c.	Total valuation.
MISSOURI.					
Indian corn ....bushels..	36,635,011	26 4/5	1,366,978	$0 97	$35,535,961
Wheat ....do....	3,281,514	14 1/6	231,092	1 75	5,742,648
Rye ....do....	237,542	15 3/8	15,168	1 11 1/8	264,463
Oats ....do....	2,128,522	25 1/4	84,297	71 1/2	1,521,893
Barley ....do....	162,809	23	7,078	1 47 3/8	240,415
Buckwheat ....do....	72,461	15 5/7	4,615	1 07	77,533
Potatoes ....do....	776,630	39	19,913	1 75 1/8	1,361,691
Tobacco..............pounds..	13,697,063	562	24,372	13 4/7	1,009,257
Hay ....tons...	399,599	1 3/7	279,719	18 12 1/2	7,242,731
Total..........................	....	....	2,033,232	....	52,996,592
WISCONSIN.					
Indian corn ....bushels..	10,087,053	31	325,388	94	9,481,829
Wheat ....do....	14,168,317	9 1/2	1,491,401	1 48 1/8	21,016,337
Rye.......................do....	810,343	12 1/4	66,150	1 09 1/5	884,624
Oats ....do....	12,043,538	27 1/2	437,945	60	7,226,123
Barley ....do....	674,919	13 1/4	50,937	1 49	1,005,629
Buckwheat ....do....	73,258	16 1/2	4,440	88 3/4	65,016
Potatoes ....do....	3,582,068	118	30,356	55	1,970,137
Tobacco ....pounds..	148,083	980	151	15	22,212
Hay ....tons...	789,765	1 1/7	691,044 3/7	13 00	10,266,945
Total..........................	....	....	3,097,812 3/7	....	51,938,852
IOWA.					
Indian corn ....bushels..	55,261,240	36 3/8	1,507,124	67 5/8	37,370,414
Wheat ....do....	12,649,807	12 1/4	1,032,637	1 34 1/2	17,013,990
Rye.......................do....	119,333	15	7,955	92	109,786
Oats ....do....	9,313,369	32	291,042	53	4,936,086
Barley ....do....	584,446	21	27,830	1 20 1/4	702,796
Buckwheat ....do....	276,524	17 1/2	15,800	1 14	315,237
Potatoes...............do....	2,520,481	76	33,164	1 11 1/8	2,806,136
Tobacco..............pounds..	390,522	957	408	25	97,630
Hay ....tons...	814,764	1 5/8	501,394	9 51	7,748,406
Total..........................	....	....	3,417,354	....	71,100,481
MINNESOTA.					
Indian corn ....bushels..	4,647,329	33	140,828	94	4,368,485
Wheat ....do....	2,634,975	13 1/8	197,672	1 13 3/8	2,995,088
Rye ....do....	161,974	14 1/8	11,303	92	149,016
Oats ....do....	2,259,232	28 3/4	78,582	73 1/2	1,660,536
Barley ....do....	148,592	20	1,429	1 09 1/6	163,212
Buckwheat ....do....	31,714	17 3/8	1,796	1 23 1/8	39,114
Potatoes ....do....	2,163,141	112	19,313	67 1/7	1,452,395
Tobacco ....pounds..	34,659	800	43 1/8	20	6,932
Hay ....tons...	249,289	1 1/2	166,192	9 36	2,333,345
Total..........................	....	....	617,158	....	13,168,123

TABLE B—Continued.

Products.	Amount of crop of 1864.	Average yield per acre.	Number of acres in each crop.	Value per bushel, pound, &c.	Total valuation.
KANSAS.					
Indian corn ....bushels..	4,673,081	25	186,923	$1 37	$6,402,121
Wheat ....do....	201,598	15	13,439	2 01	405,212
Rye ....do....	4,061	17	239	1 25	5,076
Oats ....do....	146,500	29	5,051	96½	141,372
Barley ....do....	5,901	23	256	1 27	7,494
Buckwheat ....do....	24,288	15	1,619	1 25	30,360
Potatoes ....do....	184,480	43	4,290	2 68	494,406
Tobacco ....pounds..	22,043	675	32⅔	11¼	2,480
Hay ....tons...	82,569	1⅔	49,541	13 00	1,073,397
Total..................	....	....	261,390⅔	....	8,561,918
NEBRASKA TERRITORY.					
Indian corn ....bushels..	1,366,622	28½	47,951	99	1,352,956
Wheat ....do....	126,000	14	9,000	1 50	189,000
Rye ....do....	1,600	16	100	1 29	2,064
Oats ....do....	223,284	28	7,974	68⅓	152,577
Barley ....do....	4,630	20	231	1 22½	5,672
Buckwheat ....do....	....	....	....	....	....
Potatoes ....do....	106,102	51⅔	2,053¾	2 08	220,692
Tobacco ....pounds..	1,140	....	....	....	....
Hay ....tons...	18,391	1⅓	13,793	7 33	134,806
Total..................	....	....	81,102	....	2,057,767

TABLE C.

Summary for each State, showing the amount, the number of acres, and the value of each crop for 1864.

States.	INDIAN CORN.			WHEAT.			RYE.		
	Bushels.	Acres.	Value of crop.	Bushels.	Acres.	Value of crop.	Bushels.	Acres.	Value of crop.
Maine	1,410,017	52,223	$2,961,036	167,194	15,999	$434,704	128,612	10,718	$263,012
New Hampshire	1,334,628	45,242	2,816,065	251,518	20,121	674,068	109,373	7,543	223,121
Vermont	1,585,020	40,851	3,106,639	497,951	35,568	1,282,224	140,798	9,263	264,760
Massachusetts	2,280,324	72,319	4,651,861	128,143	8,009	308,825	413,957	27,597	827,914
Rhode Island	474,208	15,676	991,095	1,413	94	3,532	37,302	2,194	74,604
Connecticut	2,059,835	66,446	3,728,301	71,881	4,356	170,717	721,889	48,126	1,378,808
New York	22,628,862	771,526	38,016,488	10,918,615	839,893	25,622,350	5,205,759	359,018	8,875,819
New Jersey	8,464,262	267,349	14,401,337	1,582,113	105,474	3,686,323	1,424,523	105,520	2,414,566
Pennsylvania	28,381,685	962,091	43,920,658	12,523,404	1,043,617	30,056,170	6,843,427	480,240	11,645,232
Maryland	10,509,243	488,802	17,024,974	6,487,946	564,178	16,868,660	529,744	37,838	868,780
Delaware	3,892,337	191,458	6,033,122	1,054,954	87,912	2,668,834	41,153	2,627	64,473
Kentucky	42,828,706	1,502,761	41,399,749	3,882,275	378,758	7,628,670	554,014	41,344	750,689
Ohio	68,202,641	2,176,911	65,474,535	20,407,503	1,990,976	39,386,481	704,974	57,548	931,741
Michigan	11,088,801	455,766	13,971,889	13,966,153	1,163,846	27,373,660	434,894	35,419	592,905
Indiana	74,284,363	2,561,529	70,941,567	22,321,376	1,594,384	39,062,308	397,632	28,402	520,898
Illinois	138,356,135	4,192,610	103,767,101	33,371,173	2,328,763	51,725,318	850,071	56,671	862,822
Missouri	36,635,011	1,366,978	35,535,961	3,281,514	231,092	5,742,648	237,542	15,168	264,463
Wisconsin	10,087,053	325,388	9,481,829	14,168,317	1,491,401	21,016,337	810,343	66,150	884,624
Iowa	55,261,240	1,507,124	37,370,414	12,649,807	1,032,637	17,013,990	119,333	7,955	109,786
Minnesota	4,647,329	140,828	4,368,485	2,634,975	197,672	2,995,088	161,974	11,303	149,016
Kansas	4,673,081	186,923	6,402,121	201,598	13,439	405,212	4,061	239	5,076
Nebraska Territory	1,366,622	47,951	1,352,956	126,000	9,000	189,000	1,600	100	2,064
Total	530,451,403	17,438,752	527,718,183	160,695,823	13,158,089	294,315,119	19,872,975	1,410,983	31,975,013

TABLE C.—*Summary for each State, showing the amount, the number of acres, and the value of each crop for* 1864—Continued.

States.	OATS.			BARLEY.			BUCKWHEAT.		
	Bushels.	Acres.	Value of crop.	Bushels.	Acres.	Value of crop.	Bushels.	Acres.	Value of crop.
Maine	2,102,994	95,591	$2,124,024	668,424	37,135	$970,215	350,837	18,465	$449,071
New Hampshire	1,095,891	45,662	1,008,220	96,278	5,349	162,710	87,447	4,564	115,430
Vermont	3,611,938	109,452	3,142,386	94,102	4,277	151,504	210,516	10,954	218,937
Massachusetts	1,194,827	45,430	1,242,620	149,584	7,479	266,260	110,972	6,829	138,715
Rhode Island	182,873	5,542	180,587	41,506	1,660	68,070	3,097	....	....
Connecticut	2,011,334	67,044	2,011,334	18,732	797	33,905	387,477	23,342	523,094
New York	35,724,746	1,553,250	33,581,261	3,710,911	197,915	6,469,355	5,677,490	313,488	6,453,414
New Jersey	5,735,647	176,481	5,227,640	29,098	1,454	51,940	921,256	54,191	1,326,609
Pennsylvania	37,657,329	1,287,430	32,761,876	630,491	35,027	1,078,140	7,577,955	404,157	8,847,262
Maryland	5,429,894	246,813	4,724,008	26,591	997	47,509	189,285	9,657	299,070
Delaware	1,184,437	49,351	947,550	4,595	170	8,616	15,641	782	15,641
Kentucky	4,346,326	179,229	3,444,463	172,563	7,503	274,663	14,187	698	19,507
Ohio	14,428,833	497,546	10,417,617	1,585,630	67,016	2,473,583	1,300,141	76,479	1,430,155
Michigan	4,810,136	185,005	3,643,678	338,388	17,624	527,885	823,453	68,620	975,792
Indiana	6,084,793	234,030	4,478,408	339,198	14,133	529,149	272,171	14,712	338,399
Illinois	24,273,751	779,003	14,806,988	1,144,790	50,520	1,568,362	280,320	16,492	308,407
Missouri	2,128,522	84,297	1,521,893	162,809	7,078	240,415	72,461	4,615	77,583
Wisconsin	12,043,538	437,945	7,226,123	674,919	50,937	1,005,629	73,258	4,440	65,016
Iowa	9,313,369	291,042	4,936,086	584,446	27,830	702,796	276,524	15,800	315,237
Minnesota	2,259,232	78,582	1,660,536	148,592	1,429	163,212	31,714	1,796	39,114
Kansas	146,500	5,051	141,372	5,901	256	7,494	24,288	1,619	30,360
Nebraska Territory	223,284	7,974	152,577	4,630	231	5,672	....	....	....
Total	175,990,194	6,461,750	139,381,247	10,632,178	536,820	16,807,084	18,700,540	1,051,700	21,986,763

C.—*Summary for each State, showing the amount, the number of acres, and the value of each crop for* 1864—Continued.

States.	POTATOES.			TOBACCO.			HAY.		
	Bushels.	Acres.	Value of crop.	Pounds.	Acres.	Value of crop.	Tons.	Acres.	Value of crop.
Maine	7,189,151	50,274	$4,816,731	....	....	....	1,085,705	1,240,806	$22,799,805
New Hampshire	3,842,154	23,427	2,305,292	64,000	65	$16,000	694,161	694,161	14,577,381
Vermont	5,920,810	36,434	3,197,237	59,000	....	....	850,127	850,127	15,259,780
Massachusetts	3,384,878	25,546	3,147,937	6,760,000	4,097	1,690,000	760,517	760,517	22,054,993
Rhode Island	525,727	4,123	512,584	1,848	1 37/100	545	62,044	62,044	1,954,386
Connecticut	1,833,148	13,993	1,521 513	9,900,218	6,828	2,475,054	449,956	374,963	12,148,812
New York	29,753,312	257,984	19,637 186	12,912,662	15,085	3,212,025	3,921,264	3,547,810	90,385,135
New Jersey	3,989,179	46,033	4,308,313	179,755	25	44,939	436,496	277,770	11,660,991
Pennsylvania	12,661,424	114,759	11,268,667	6,124,551	5,732	1,133,042	1,796,336	1,381,797	44,100,049
Maryland	1,061,994	19,309	1,274,393	33,292,968	44,391	4,550,039	167,909	125,931	4,533,543
Delaware	327,540	2,620	432,353	14,057	....	....	33,111	22,074	993,330
Kentucky	1,255,921	15,474	1,377,327	56,956,469	73,969	6,834,776	112,325	84,243	2,264,472
Ohio	4,615,881	48,082	4,211,991	29,017,931	33,335	3,917,421	1,415,096	1,061,322	27,424,560
Michigan	3,422,078	43,317	2,788,994	248,473	248	49,695	847,737	762,963	16,386,756
Indiana	2,904,847	36,310	2,890,323	8,767,065	10,241	1,227,389	962,805	641,870	17,147,557
Illinois	4,511,083	55,521	5,187,745	18,867,722	20,802	3,045,789	2,166,725	1,444,483	33,215,894
Missouri	776,630	19,913	1,361,691	13,697,063	24,372	1,009,257	399,599	279,719	7,242,731
Wisconsin	3,582,068	30,356	1,970,137	148,083	151	22,212	789,765	691,044 3/7	10,266,945
Iowa	2,520,481	33,164	2,806,136	390,522	408	97,630	814,764	501,394	7,748,406
Minnesota	2,163,141	19,313	1,452,395	34,659	43 1/8	6,932	249,289	166,192	2,333,345
Kansas	184,480	4,290	494,406	22,043	32 3/8	2,480	82,569	49,541	1,073,397
Nebraska Territory	106,102	2,053	220,692	1,140	....	....	18,391	13,793	134,806
Total	96,532,029	902,295	77,184,043	197,460,229	239,826 37/100	29,335,225	18,116,691	15,034,564 3/7	365,707,074

TABLE D.

General summary showing the number of bushels, &c., of each crop, the number of acres of each, the value of each, and the bushels, acres, and value of all, and the increase and decrease of the same, for the years 1863 *and* 1864, *and the comparison between the same years.*

AMOUNT OF CROPS.

	1863.	1864.	Increase.	Decrease.
Indian corn	397,839,212	530,451,403	132,612,191	
Wheat	173,677,928	160,695,823		12,982,105
Rye	19,989,335	19,872,975		116,360
Oats	170,129,864	175,990,194	5,860,330	
Barley	12,158,195	10,632,178		1,526,017
Buckwheat	15,786,122	18,700,540	2,914,418	
Potatoes	98,965,198	96,532,029		2,433,169
Total	888,546,554	1,012,875,142	141,386,939	17,057,651
Tobacco	163,353,082	197,460,229	34,107,147	
Hay	18,346,730	18,116,691		230,039

ACREAGE OF CROPS.

	1863.	1864.	Increase.	Decrease.
Indian corn	15,312,441	17,438,752	2,126,311	
Wheat	13,098,936	13,158,089	59,153	
Rye	1,439,607	1,410,983		28,624
Oats	6,686,174	6,461,750		224,424
Barley	557,299	536,820		20,479
Buckwheat	1,054,060	1,051,700		2,360
Potatoes	1,129,804	902,295		227,509
Tobacco	216,423	239,826	23,403	
Hay	15,641,504	15,034,564		606,940
Total	55,136,248	56,234,779	2,208,867	1,110,336

VALUE OF CROPS.

	1863.	1864.	Increase.	Decrease.
Indian corn	$278,089,609	$527,718,183	$249,628,574	
Wheat	197,992,837	294,315,119	96,322,282	
Rye	20,589,015	31,975,013	11,385,998	
Oats	105,990,905	139,381,247	33,390,342	
Barley	13,496,373	16,807,084	3,310,711	
Buckwheat	12,660,469	21,986,763	9,326,294	
Potatoes	55,024,650	77,184,043	22,159,393	
Tobacco	24,239,609	29,335,225	5,095,616	
Hay	247,680,855	365,707,074	118,026,219	
Total	955,764,322	1,504,409,751	548,645,429	

The above tables of the general summary do not show the exact comparative differences between the years 1863 and 1864, because the latter year embraces the crops of Kentucky, which are not in the year of 1863. Deducting Kentucky from 1864, the comparison will be as follows:

Table of comparison between 1863 *and* 1864.

	1863.	1864.	Increase.	Decrease.
Total, bushels	888,546,554	959,821,150	71,274,596	
Total tobacco, pounds	163,353,082	140,503,760		22,849,322
Total hay, tons	18,346,730	18,004,366		342,364
Total acreage	55,136,248	53,950,797		1,185,451
Total value of crops	$955,764,322	$1,440,415,435	$484,651,113	

Explanation and comment on the foregoing tables.

The first of these three tables exhibits the *amount*, the *yield* per acre, the *total acreage*, the *price* per bushel, &c., and the *total value* of each of the crops named in the several States. The *amount* is estimated from the returns of correspondents in *tenths*, increase or decrease, of the preceding crops, and the *yield* per acre and *price* per bushel, &c., from their returns also. The average yield per acre and the average price per bushel, &c., are ascertained for each State from them. The *total acreage* is derived by dividing the yield per acre into the amount of the crop, and the *total value* by multiplying the price per bushel, &c., into the amount.

A more accurate way would be to make this division and multiplication into the crops of each county, instead of into the estimates for each State, but this cannot be done, for the Interior Department has not yet published them as given by the census returns of 1860. The returns of each State, as given in the abridged census report, is the basis upon which the amount of the crops for 1862, 1863, and 1864 have been estimated. But as the excess of one county is much counterbalanced by the deficiency of another, or more than counterbalanced by a third, the general result, in this way, from the many returns for each State, affords a much closer approximation than would be supposed at first view. This fact we have determined by various means.

The prices for 1863 were taken in November of that year, and for 1864 on the 1st day of January, 1865. This time is best to show the value of the crops to the farmer, as so large a portion of the corps is sold in October, November, and December.

The table of comparison, between 1863 and 1864, exhibits much that is interesting. There is a large increase in the number of bushels of grain, (71,274,596,) a decrease in tobacco of 22,849,322 pounds, a decrease of hay of 342,264 tons, a decrease in the acreage of 1,185,451 acres, but an increase in value of $484,651,113.

The first increase is from the corn crop, which regained nearly all of its loss in 1863; the second from the condition of the currency, and is a subject of not only present but future interest.

The *value* of the corps, the market value of gold when the prices were taken, and the per cent. increase of the value of both, are as follows:

Years.	Value of crops.	Rate of gold.	Gold, increase per cent.	Increase value of crops per cent.
1862	$706,887,495	131		
1863	955,764,322	147	12	35
1864	1,440,415,435	227	54	50

An examination of the increase of the different crops in 1863 shows that it was chiefly in those most demanded by government for war purposes; hence the difference between 12 per cent. and 35 per cent., being 23 per cent., may be attributed to the advance in value occasioned chiefly by the war demand. The increase in gold value in 1864 is 4 per cent. over the increase in the value of the corps of that year, the one being 54 per cent., the other 50 per cent. This comparative decrease in the value of the crops may be attributed to the decreased foreign demand, as seen in the decreased exports.

The total increase from November, 1862, to January 1, 1865, in gold value is 73 per cent., and of the value of crops 103 per cent., showing the war demand chiefly has added about 30 per cent. to the value of the crops, and the increased value of gold over currency about 73 per cent.

EXPLANATION OF THE FOLLOWING TABLES.

It will be seen from *Table* A that the *prices* of the stock are desired for *different ages*. It was thought that correspondents could more certainly state the prices of different ages than to estimate the average price of all ages. As there were scarcely any data by which the proportion of the numbers in each of these ages could be determined, no State or national census having ever separated the ages, it was no easy task to determine this proportion. It differs in different States. A State that raises and sells a particular stock, but does not buy it, will have a larger proportion of younger animals than one that raises few and buys a good many, for those purchased are of the older ages.

It is important to determine the value of this stock—as much so as that of the crops, and from both, *deducting the value of the food given to the stock that is embraced in the value of crops*, to estimate the value of all products of agriculture. To approximate to the *actual* value is desirable, for in this way could be seen the influences on market values of supply and demand, and of the condition of the currency. In Ireland the prices given to the stock are arbitrary, having no reference to market values. Mr. Pringle says of it:

"The Irish registrar-general has been in the habit of including a table in his returns, showing the estimated value of live stock in each year. These estimates are calculated according to the rates assumed by the census commissioners of 1841, namely: for horses, $38 40 each; cattle, $31 40; sheep, $5 28; and pigs, $6. *This I consider a weak point in the Irish statistical returns.* It is all very well to retain those rates for the purpose of comparison, since they have been adopted; but some means should be taken to arrive at a closer estimate of the *real* value of the live stock, for the assumed rates are now much beneath an actual average. Thus the average prices of cattle and sheep at the last October fair at Ballinasloe were as follows:

"*Cattle.*—First class oxen and heifers, $98 40; second-class oxen, $81 60; heifers, $74 40; third-class oxen, $61 20; heifers, $52 80; fourth-class oxen, $36 60; heifers, $36.

"*Sheep.*—First-class wethers and ewes, $15 12; second-class wethers, $12; ewes, $12 96; third class wethers, $8 88; ewes, $9 60; fourth-class wethers and ewes, $7 20."

This mode is certainly a "weak point," as it totally disregards an approximation to the *real* values. The plan of this department is to take the prices in January at the market places of each county, and from these take a general average in the State, and by it calculate the value, by multiplying it into the total of each kind of live stock of the State. The prices in January, as a general thing, fairly represent the value of the year round to the farmer, for if spring sales are higher, they are not more so if to the January sales the cost of keep-

ing be added. In January, too, the heavy sales of early winter are closing, and usually show the averages of those sales. The superiority of this practice over the *fixed* rates adopted in the Irish estimates will be seen at a glance.

As just stated, it was no easy matter to fix a general estimate of the proportion of the number of each age embraced in the interrogatories to the correspondents, and after much consideration the following proportions were fixed on:

Horses and mules.—1 year old and under, *one-seventh* of the whole number; between 1 and 2 years old, *one-fourth* of the whole number; between 2 and 3 years old, *one third* of the whole number; over 3 years old, the *remainder*.

Cattle and oxen.—1 year old and under, *one-sixth* of the whole number; between 1 and 2 years old, *two-sevenths* of the whole number; between 2 and 3 years old, *one-third* of the whole number; over 3 years old, the *remainder*.

Cows.—No distinction of ages.

Sheep.—Under 1 year old, *one-fourth* of the whole number; over 1 year old, *three-fourths* of the whole number.

Hogs.—Under 1 year old, *three-fourths* of the whole number; over 1 year old, *one-fourth* of the whole number.

Table B exhibits the numbers and value of the live stock as divided and valued by the foregoing proportions, estimated by the average prices of table A.

Table C shows the *total value* of each kind of live stock, and the average price ascertained by dividing the whole number of each kind of stock into the total value of each.

Table D is the same table in effect as C, but so arranged as to show the value of the live stock of each State separately.

Table E exhibits the total numbers for 1864 and 1865, the increase and decrease of each kind, the general average price of each kind, and the total value of all live stock in January, 1865.

TABLE No. 2—THE FARM STOCK OF 1864

The tables of this stock for 1864, but taken in January, 1865, are divided as follows:

A. Showing the questions asked the correspondents relative to the numbers and prices of this stock, as to their different ages, and the general average of these for each State, the numbers being stated in *tenths*, and in comparison with those of January, 1864.

B. Exhibiting the actual number estimated from the answers in tenths as given in the previous table, (A,) the prices and value of each kind of stock according to their different ages.

C. Exhibiting the total number of each kind of stock, the average price for all ages, and the total value of each kind as estimated by this average price.

D. Showing the total number and value of each kind of stock for *each* of the States as estimated by the average price in the last table, (C.)

E Showing the total number of each kind of live stock for *all* of the States for 1864 and 1865 as taken in the month of January in each of these years, the increase and decrease of the same, and the average price for each stock for *all* these States, and the total value of each and all.

TABLE A—*Showing the amount, in tenths, of the stock of the loyal States in January*, 1865, *as compared with the amount in January* 1864, *and the prices of the same for the different ages in January*, 1865.

STATES.	HORSES.					MULES.					MILCH COWS.	
	Average number of horses compared with that of January, 1864.	Average price per head of same under 1 year old.	Average price per head of same between 1 and 2 years old.	Average price per head of same between 2 and 3 years old.	Average price per head of same over 3 years old.	Average number of mules compared with that of January, 1864.	Average price per head of same under 1 year old.	Average price per head of same between 1 and 2 years old.	Average price per head of same between 2 and 3 years old.	Average price per head of same over 3 years old.	Average number of milch cows compared with that of January, 1864.	Average price per head of cows at that time.
Maine	$9\frac{1}{4}$	$34 72	$54 50	$80 22	$112 25	....	....	....	....	....	9	$43 70
New Hampshire	9	28 89	48 30	69 00	101 70	....	....	....	....	....	$8\frac{4}{5}$	39 30
Vermont	$9\frac{1}{9}$	34 33	56 33	77 33	111 11	....	....	....	....	....	$9\frac{2}{3}$	43 11
Massachusetts	$9\frac{3}{10}$	38 33	55 22	76 66	111 70	....	....	....	....	....	8	52 50
Rhode Island	$9\frac{2}{3}$	33 33	58 00	88 33	111 67	....	....	....	....	....	10	46 67
Connecticut	10	35 60	58 40	84 00	119 00	....	....	....	....	....	10	40 60
New York	$8\frac{9}{11}$	38 11	64 44	92 65	122 00	$10\frac{4}{11}$	$44 11	$76 61	$111 77	$151 50	10	44 31
New Jersey	$9\frac{1}{2}$	49 58	80 83	115 41	142 29	10	48 54	78 73	115 64	152 77	$9\frac{1}{2}$	48 00
Pennsylvania	$9\frac{1}{8}$	40 19	67 02	97 70	113 51	$10\frac{1}{8}$	47 22	81 00	125 35	158 37	$9\frac{1}{8}$	39 22
Maryland	9	37 34	58 84	80 84	125 81	10	43 14	68 57	100 50	152 50	$9\frac{3}{10}$	38 00
Delaware	$8\frac{1}{4}$	35 00	54 00	77 00	120 50	9	....	....	....	....	$8\frac{1}{4}$	42 50
Kentucky	$7\frac{2}{3}$	41 25	58 95	78 95	105 00	8	55 63	78 91	110 20	130 87	9	42 29
Ohio	$8\frac{5}{6}$	33 78	53 96	78 00	107 57	9	47 38	76 00	109 11	141 51	$8\frac{5}{6}$	35 13
Michigan	$10\frac{1}{2}$	36 96	58 75	88 27	121 75	$11\frac{1}{2}$	45 41	72 72	106 36	147 79	10	32 27
Indiana	$9\frac{3}{7}$	36 12	57 78	81 60	113 13	$9\frac{1}{2}$	47 26	76 00	105 00	138 16	9	32 07
Illinois	$9\frac{4}{7}$	38 43	60 00	87 65	117 39	10	51 70	67 73	113 00	148 00	$9\frac{1}{2}$	30 46
Missouri	8	38 50	57 74	85 76	107 00	$7\frac{3}{4}$	52 73	72 00	112 00	145 36	9	20 61
Wisconsin	$10\frac{1}{2}$	36 14	54 77	84 44	115 86	$11\frac{1}{4}$	53 42	79 00	112 25	148 73	$10\frac{1}{6}$	28 78
Iowa	$10\frac{2}{3}$	41 28	61 65	90 93	121 87	10	53 47	79 06	112 65	153 00	$10\frac{2}{5}$	26 68
Minnesota	12	41 47	66 52	89 94	120 00	11	53 62	76 87	117 50	158 00	$11\frac{1}{2}$	26 35
Kansas	$11\frac{1}{6}$	33 00	53 61	85 00	115 83	11	51 93	77 93	114 11	161 75	$12\frac{2}{3}$	26 66
West Virginia	$8\frac{4}{10}$	37 00	57 00	79 00	104 54	$8\frac{7}{10}$	42 00	63 00	90 00	123 00	9	32 81
Nebraska Territory	$13\frac{1}{2}$	39 54	64 54	92 72	120 91	$13\frac{3}{10}$	60 28	88 43	136 00	167 22	$13\frac{1}{4}$	30 63

TABLE A—*Showing the amount, in tenths, of the stock of the loyal States in January, 1865, &c.*—Continued.

STATES.	CATTLE AND OXEN.					SHEEP.			HOGS.		
	Average number of cattle and oxen compared with that of January, 1864.	Average price per head of same under 1 year old.	Average price per head of same between 1 and 2 years old.	Average price per head of same between 2 and 3 years old.	Average price per head of same over 3 years old.	Average number of sheep compared with that of January, 1864.	Average price per head of same under 1 year old.	Average price per head of same over 1 year old.	Average number of hogs compared with that of January, 1864.	Average price of same per head under 1 year old.	Average price of same per head over 1 year old.
Maine	$8\frac{2}{11}$	$12 11	$23 94	$37 27	$68 19	11	$4 57	$5 89	$8\frac{2}{10}$	$14 21	$23 40
New Hampshire	8	11 10	20 40	34 00	67 00	$11\frac{6}{10}$	4 22	5 85	$7\frac{7}{10}$	15 50	30 00
Vermont	8	9 78	21 44	39 33	70 00	$11\frac{1}{4}$	4 44	6 50	$8\frac{4}{9}$	15 00	28 33
Massachusetts	9	12 50	24 50	40 75	68 75	$10\frac{4}{10}$	4 48	6 84	8	14 85	31 43
Rhode Island	10	12 33	22 67	38 33	63 33	10	5 00	6 83	$8\frac{1}{8}$	14 00	26 66
Connecticut	$9\frac{1}{9}$	10 00	20 40	38 00	68 00	10	4 00	6 70	$7\frac{4}{5}$	14 00	27 50
New York	$8\frac{3}{4}$	11 58	21 41	35 83	62 00	$10\frac{4}{5}$	4 26	5 93	$8\frac{1}{2}$	11 90	20 82
New Jersey	$8\frac{3}{4}$	14 45	23 08	35 21	63 58	9	4 64	6 77	$8\frac{1}{8}$	12 58	23 00
Pennsylvania	9	11 42	19 71	31 48	49 24	11	4 07	6 15	$8\frac{1}{2}$	9 21	20 81
Maryland	$8\frac{8}{10}$	9 92	16 54	26 61	42 30	$11\frac{2}{13}$	4 95	7 71	$8\frac{8}{13}$	7 50	17 66
Delaware	$7\frac{3}{4}$	10 50	20 00	35 00	48 00	$8\frac{3}{4}$	4 50	6 50	8	10 50	27 50
Kentucky	$8\frac{1}{2}$	10 33	20 20	34 33	52 12	$10\frac{1}{2}$	4 10	6 00	$8\frac{1}{3}$	5 34	11 52
Ohio	$8\frac{2}{3}$	9 44	17 41	28 87	45 71	$12\frac{1}{8}$	3 96	6 00	$7\frac{2}{3}$	6 94	16 24
Michigan	9	7 83	15 72	27 48	49 00	$12\frac{1}{4}$	3 79	5 68	$8\frac{1}{2}$	5 26	13 23
Indiana	$8\frac{1}{3}$	7 89	15 10	25 14	38 68	$12\frac{7}{10}$	3 53	5 11	$7\frac{6}{10}$	5 44	12 03
Illinois	$9\frac{3}{5}$	7 78	14 69	23 71	38 58	$12\frac{2}{3}$	3 93	5 70	$8\frac{4}{10}$	6 85	14 18
Missouri	$7\frac{3}{8}$	6 22	12 36	21 00	35 70	$10\frac{3}{4}$	2 51	4 19	7	3 40	8 61
Wisconsin	9	7 63	14 06	23 41	41 45	14	4 43	6 18	$8\frac{1}{2}$	6 00	13 65
Iowa	10	7 91	14 72	25 17	41 82	$14\frac{1}{5}$	4 19	6 00	9	5 68	12 00
Minnesota	$10\frac{4}{10}$	8 94	14 70	21 79	40 19	$15\frac{1}{4}$	3 98	5 64	$9\frac{1}{2}$	6 23	15 00
Kansas	$12\frac{1}{9}$	8 00	15 44	27 55	45 77	14	3 78	5 56	$7\frac{3}{10}$	3 63	10 16
West Virginia	$8\frac{7}{10}$	7 60	15 80	25 30	38 45	$10\frac{8}{10}$	2 70	4 27	8	5 00	11 36
Nebraska Territory	$12\frac{1}{2}$	9 81	17 46	28 50	48 20	$18\frac{1}{8}$	4 37	6 68	$9\frac{1}{2}$	5 18	12 20

TABLE B—*Showing the numbers, price, and value of the live stock in each State, for the different ages named in Table No. 1, in the month of January,* 1865.

STATES.	HORSES UNDER ONE YEAR OLD.			HORSES BETWEEN ONE AND TWO YEARS OLD.			HORSES BETWEEN TWO AND THREE YEARS OLD.			HORSES OVER THREE YEARS OLD.		
	Number.	Average price.	Total value.	Number.	Average price.	Total value.	Number.	Average price.	Total value.	Number.	Average price.	Total value.
Maine	7,450	$34 72	258,664	13,037	$54 50	$710,516	17,382	$80 22	$1,394,384	14,278	$112 25	$1,602,705
New Hampshire	4,915	28 89	118,882	8,601	48 30	415,428	11,468	69 00	791,292	9,420	101 70	958,014
Vermont	7,131	34 33	244,807	12,480	56 33	702,998	16,640	77 33	1,286,771	13,669	111 11	1,518,762
Massachusetts	6,930	38 33	265,627	12,127	55 22	669,653	16,169	76 66	1,239,515	13,283	111 70	1,483,711
Rhode Island	1,009	33 33	33,630	1,766	58 00	102,486	2,354	88 33	207,929	1,934	111 67	215,970
Connecticut	4,936	35 60	175,721	8,638	58 40	504,459	11,518	84 00	967,512	9,462	119 00	1,125,978
New York	58,395	38 11	2,225,433	102,191	64 44	6,585,188	136,254	92 65	12,623,933	111,923	122 00	13,654,606
New Jersey	11,245	49 58	557,527	19,679	80 83	1,590,653	26,238	115 41	3,028,127	21,553	142 29	3,066,776
Pennsylvania	54,612	40 19	2,194,856	95,572	67 02	6,405,235	127,429	97 70	12,449,923	104,675	113 51	11,881,659
Maryland	11,231	37 34	419,365	19,655	58 84	1,156,500	26,206	80 84	2,118,493	21,528	125 81	2,708,438
Delaware	2,016	35 00	70,560	3,528	54 00	190,512	4,704	77 00	362,208	3,864	120 50	465,612
Kentucky	29,876	41 25	1,232,385	52,284	58 95	3,082,142	69,712	78 95	5,513,762	57,264	105 00	6,012,720
Ohio	74,356	33 78	2,511,746	130,124	53 96	7,021,491	173,499	78 00	13,532,922	142,518	107 57	15,330,661
Michigan	23,252	36 96	859,394	40,942	58 75	2,405,342	54,589	88 27	4,818,571	44,985	121 75	5,476,923
Indiana	51,242	36 12	1,850,861	89,673	57 78	5,181,306	119,564	81 60	9,756,422	98,213	113 13	11,110,837
Illinois	78,645	38 43	3,022,327	137,628	60 00	8,257,680	183,504	87 65	16,084,126	150,736	117 39	17,694,899
Missouri	31,135	38 50	1,198,697	54,486	57 74	3,146,022	72,647	85 76	6,230,207	59,675	107 00	6,385,225
Wisconsin	22,010	36 14	795,441	38,517	54 77	2,109,576	51,355	84 44	4,336,416	42,185	115 86	4,887,554
Iowa	43,989	41 28	1,815,866	76,981	61 65	4,745,879	102,641	90 93	9,271,561	84,312	121 87	10,275,103
Minnesota	4,540	41 47	188,274	7,945	66 52	528,501	10,594	89 94	952,824	8,703	120 00	1,044,360
Kansas	3,976	33 00	131,208	6,957	53 61	372,965	9,276	85 00	788,460	7,621	115 83	882,740
Nebraska Territory	1,384	39 54	54,723	2,422	64 54	156,316	3,229	92 72	299,393	2,652	120 91	320,653
Total	534,275	....	20,225,994	935,233	....	56,040,848	1,246,972	....	108,054,751	1,024,453	....	118,103,906

TABLE B—*Showing the numbers, price, and value of the live stock in each State, &c.*—Continued.

STATES.	MULES UNDER ONE YEAR OLD.			MULES BETWEEN ONE AND TWO YEARS OLD.			MULES BETWEEN TWO AND THREE YEARS OLD.			MULES OVER THREE YEARS OLD.			CATTLE ONE YEAR OLD AND UNDER.		
	Number.	Average price.	Total value.	Number.	Average price.	Total value.	Number.	Average price.	Total value.	Number.	Average price.	Total value.	Number.	Average price.	Total value
Maine	18	....	....	31	....	....	41	....	....	34	....	....	28, 803	$12 11	$348, 804
New Hampshire	1	....	....	2	....	....	3	....	....	4	....	....	20, 253	11 10	224, 808
Vermont	5	....	....	9	....	....	12	....	....	9	....	....	25, 349	9 78	247, 913
Massachusetts	17	....	....	30	....	....	39	....	....	33	....	....	20, 479	12 50	255, 987
Rhode Island	2	....	....	3	....	....	4	....	....	3	....	....	3, 425	12 33	41, 230
Connecticut	13	....	....	22	....	....	29	....	....	24	....	....	22, 199	10 00	221, 990
New York	247	$44 11	$10, 895	433	$76 61	$33, 172	577	$111 77	$64, 491	475	$151 50	$71, 962	121, 068	11 58	1, 411, 967
New Jersey	975	48 54	47, 326	1, 704	78 73	134, 156	2, 272	115 64	262, 734	1, 865	152 77	284, 916	14, 797	14 45	213, 816
Pennsylvania	1, 498	47 22	70, 735	2, 621	81 00	212, 301	3, 495	125 35	438, 098	2, 872	158 37	454, 839	115, 558	11 42	1, 319, 672
Maryland	1, 371	43 14	59, 145	2, 350	68 57	161, 139	3, 200	100 50	321, 600	2, 678	152 50	408, 395	21, 411	9 92	212, 397
Delaware	321	....	....	562	....	....	750	....	....	617	....	....	4, 567	10 50	47, 953
Kentucky	10, 243	55 63	569, 818	17, 925	78 91	1, 414, 462	23, 900	110 20	2, 633, 780	19, 634	130 87	2, 569, 501	60, 271	10 33	622, 599
Ohio	1, 077	47 38	51, 028	1, 885	76 00	143, 260	2, 513	109 11	274, 193	2, 064	141 51	292, 077	124, 829	9 44	1, 178, 386
Michigan	88	45 41	3, 996	154	72 72	11, 199	206	106 36	21, 910	170	147 79	25, 124	54, 816	7 83	429, 209
Indiana	2, 791	47 26	131, 803	4, 884	76 00	371, 184	6, 511	105 00	683, 655	5, 349	138 16	739, 018	91, 093	7 89	718, 724
Illinois	7, 037	51 70	363, 813	12, 564	67 73	850, 960	16, 419	113 00	1, 855, 347	13, 237	148 00	1, 959, 076	163, 116	7 78	1, 269, 042
Missouri	7, 092	52 73	373, 961	12, 411	72 00	893, 592	16, 548	112 00	1, 853, 376	13, 594	145 36	1, 976, 024	78, 502	6 22	488, 282
Wisconsin	247	53 42	13, 195	432	79 00	34, 128	576	112 25	64, 656	472	148 73	70, 201	64, 793	7 63	494 370
Iowa	1, 744	53 47	93, 252	3, 051	79 06	241, 212	4, 069	112 65	458, 373	3, 342	153 00	511, 326	93, 556	7 91	739, 828
Minnesota	94	53 62	5, 040	165	76 87	12, 683	220	117 50	25, 850	180	158 00	28, 440	21, 196	8 94	189, 492
Kansas	323	51 93	16, 773	566	77 93	44, 108	755	114 11	86, 153	620	161 75	100, 285	19, 743	8 00	157, 944
Nebraska Territory	161	60 28	9, 705	282	88 43	24, 937	377	136 00	51, 272	310	167 22	51, 838	8, 934	9 81	88, 542
Total	35, 365	....	1, 820, 485	62, 086	....	4, 582, 493	82, 516	....	9, 095, 488	67, 586	....	9, 543, 022	1, 178, 758	....	10, 922, 955

TABLE B—*Showing the numbers, price, and value of the live stock in each State, &c.*—Continued.

STATES.	CATTLE BETWEEN ONE AND TWO YEARS OLD.			CATTLE BETWEEN TWO AND THREE YEARS OLD.			CATTLE OVER THREE YEARS OLD.			COWS.		
	Number.	Average price.	Total value.	Number.	Average price.	Total value.	Number.	Average price.	Total value.	Number.	Average price.	Total value.
Maine	49, 378	$23 94	$1, 182, 109	57, 607	$37 27	$2, 147, 012	37, 035	$68 19	$2, 525, 416	135, 059	$43 70	$5, 802, 078
New Hampshire	34, 720	20 40	708, 288	40, 507	34 00	1, 377, 238	26, 041	67 00	1, 744, 747	77, 000	39 30	3, 026, 100
Vermont	43, 456	21 44	931, 696	30, 698	39 33	1, 207, 350	52, 592	70 00	3, 677, 940	162, 356	43 11	6, 999, 167
Massachusetts	35, 107	24 50	860, 121	40, 958	40 75	1, 669, 038	26, 330	68 75	1, 930, 187	134, 121	52 50	7, 041, 352
Rhode Island	5, 872	22 67	123, 118	6, 851	38 33	262, 598	4, 405	63 33	278, 968	21, 290	46 67	993, 604
Connecticut	38, 056	20 40	776, 340	44, 398	38 00	1, 687, 124	28, 542	68 00	1, 940, 856	109, 714	40 60	4, 454, 368
New York	207, 546	21 41	4, 443, 559	242, 137	35 83	8, 575, 768	155, 661	62 00	9, 650, 982	1, 220, 200	44 31	54, 067, 062
New Jersey	25, 367	23 08	585, 470	29, 594	35 21	1, 042, 004	19, 026	63 58	1, 209, 673	135, 693	48 00	6, 513, 264
Pennsylvania	198, 100	19 71	3, 924, 361	231, 117	31 48	7, 275, 563	148, 576	49 24	7, 315, 882	655, 397	39 22	25, 704, 470
Maryland	36, 705	16 54	607, 100	42, 823	26 61	1, 139, 520	27, 530	42 30	1, 164, 519	94, 845	38 00	3, 604, 110
Delaware	7, 828	20 00	156, 560	9, 134	35 00	319, 690	5, 874	48 00	281, 772	19, 215	42 50	816, 637
Kentucky	103, 322	20 20	2, 087, 104	120, 542	34 33	4, 138, 206	77, 492	52 12	4, 038, 883	172, 346	42 29	7, 288, 512
Ohio	213, 994	17 41	2, 377, 435	249, 659	28 87	7, 207, 655	160, 497	45 71	7, 336, 317	609, 799	35 13	21, 422, 238
Michigan	93, 972	15 72	1, 477, 239	109, 633	27 48	3, 012, 714	70, 480	49 00	3, 453, 520	220, 825	32 27	7, 126, 022
Indiana	156, 158	15 10	2, 357, 985	182, 186	25 14	4, 580, 156	117, 121	38 68	4, 530, 240	455, 140	32 07	14, 596, 339
Illinois	279, 628	14 69	4, 107, 735	326, 233	23 71	7, 734, 984	209, 723	38 58	8, 091, 113	551, 327	30 46	16, 793, 420
Missouri	134, 574	12 36	1, 663, 334	157, 002	21 00	3, 297, 042	100, 928	35 70	3, 603, 129	272, 718	20 61	5, 620, 717
Wisconsin	111, 074	14 06	1, 561, 700	129, 586	23 41	3, 033, 608	83, 307	41 45	3, 453, 075	270, 749	28 78	7, 792, 156
Iowa	160, 382	14 72	2, 360, 823	187, 112	25 17	4, 709, 609	120, 288	41 82	5, 030, 443	294, 131	26 68	7, 847, 415
Minnesota	36, 336	14 70	534, 139	42, 392	21 79	923, 721	27, 251	40 19	1, 095, 217	78, 768	26 35	2, 075, 537
Kansas	33, 846	15 44	522, 582	39, 353	27 55	1, 084, 175	15, 519	45 77	710, 304	59, 998	26 66	1, 599, 546
Nebraska Territory	15, 316	17 46	267, 417	17, 868	28 50	509, 238	11, 488	48 20	553, 721	17, 439	30 63	534, 156
Total	2, 020, 737	....	33, 616, 215	2, 347, 390	....	66, 934, 013	1, 525, 706	....	73, 616, 904	5, 768, 130	....	211, 718, 270

TABLE B—*Showing the numbers, price, and value of the live stock in each State, &c.*—Continued.

STATES.	SHEEP UNDER ONE YEAR OLD.			SHEEP OVER ONE YEAR OLD.			HOGS UNDER ONE YEAR OLD.			HOGS OVER ONE YEAR OLD.		
	Number.	Average price.	Total value.	Number.	Average price.	Total value.	Number.	Average price.	Total value.	Number.	Average price.	Total value.
Maine	226, 462	$4 57	$1, 034, 931	679, 385	$5 89	$3, 901, 578	28, 666	$14 21	$407, 344	9, 555	$23 40	$223, 587
New Hampshire	163, 928	4 22	691, 776	491, 786	5 85	2, 876, 948	24, 593	15 50	381, 191	8, 197	30 00	245, 910
Vermont	313, 022	4 44	1, 389, 818	939, 067	6 50	6, 103, 935	24, 334	15 00	365, 010	8, 111	28 33	229, 785
Massachusetts	50, 489	4 48	226, 191	151, 468	6 84	1, 036, 041	37, 958	14 85	563, 676	12, 653	31 43	397, 684
Rhode Island	8, 156	5 00	40, 780	24, 468	6 83	167, 116	9, 070	14 00	126, 980	3, 024	26 66	80, 620
Connecticut	44, 836	4 00	179, 344	134, 507	6 70	901, 197	39, 267	14 00	549, 738	13, 089	27 50	359, 947
New York	1, 144, 077	4 26	4, 873, 768	3, 432, 233	5 93	20, 353, 142	524, 987	11 90	6, 247, 345	174, 996	20 82	3, 643, 417
New Jersey	43, 814	4 64	203, 297	131, 442	6 77	889, 862	137, 594	12 58	1, 730, 933	45, 865	23 00	1, 054, 895
Pennsylvania	717, 876	4 07	2, 921, 755	2, 153, 627	6 15	13, 244, 806	622, 296	9 21	5, 731, 346	207, 432	20 81	4, 316, 660
Maryland	62, 518	4 95	309, 464	187, 554	7 71	1, 446, 041	246, 695	7 50	1, 850, 212	82, 232	17 66	1, 452, 217
Delaware	4, 375	4 50	19, 687	13, 125	6 50	85, 312	24, 154	10 50	253, 617	8, 045	27 50	221, 237
Kentucky	203, 350	4 10	833, 735	610, 050	6 00	3, 660, 300	1, 201, 713	5 34	6, 417, 147	400, 571	11 52	4, 614, 578
Ohio	1, 448, 835	3 96	5, 737, 387	4, 346, 505	6 00	26, 079, 030	1, 334, 382	6 94	9, 260, 611	444, 794	16 24	7, 223, 454
Michigan	755, 016	3 79	2, 861, 511	2, 265, 050	5 68	12, 865, 484	254, 772	5 26	1, 340, 101	84, 924	13 23	1, 123, 544
Indiana	613, 978	3 53	2, 167, 342	1, 841, 935	5 11	9, 412, 288	1, 519, 106	5 44	8, 263, 937	506, 368	12 03	6, 091, 607
Illinois	515, 528	3 93	2, 026, 025	1, 546, 584	5 70	8, 815, 529	1, 525, 673	6 85	10, 450, 860	508, 558	14 18	7, 211, 352
Missouri	202, 391	2 51	508, 001	607, 174	4 19	2, 544, 059	741, 643	3 40	2, 521, 586	247, 214	8 61	2, 128, 512
Wisconsin	242, 481	4 43	1, 074, 191	727, 444	6 18	4, 495, 604	255, 479	6 00	1, 532, 874	85, 159	13 65	1, 162, 420
Iowa	366, 683	4 19	1, 536, 402	1, 100, 051	6 00	6, 600, 306	1, 067, 675	5 68	6, 064, 394	355, 892	12 00	4, 270, 704
Minnesota	16, 160	3 98	64, 317	48, 481	5 64	273, 433	81, 762	6 23	509, 377	27, 254	15 00	408, 810
Kansas	15, 121	3 78	37, 157	45, 365	5 56	252, 229	76, 685	3 63	278, 366	25, 561	10 16	259, 670
Nebraska Territory	2, 718	4 37	11, 878	8, 154	6 68	54, 469	24, 667	5 18	127, 755	8, 222	12 20	100, 308
Total	7, 161, 814	....	28, 748, 757	21, 485, 455	....	126, 058, 709	9, 803, 171	....	64, 975, 400	3, 267, 716	....	46, 820, 918

TABLE C—*Showing the total number and total value of each kind of live stock, and the general average price thereof, for each State for January,* 1865.

STATES.	HORSES.			MULES.			CATTLE AND OXEN.		
	Total number.	Av'ge price.	Total value.	Total number.	Av'ge price.	Total value.	Total number.	Av'ge price.	Total value.
Maine	52,147	$70 42	$3,966,269	124	....	....	172,823	$35 89	$6,203,341
New Hampshire	34,404	66 37	2,283,616	10	....	....	121,521	33 36	4,055,081
Vermont	49,920	75 18	3,753,338	35	....	....	152,095	39 87	6,064,899
Massachusetts	48,509	78 75	3,658,506	119	....	....	122,874	38 37	4,715,333
Rhode Island	7,063	79 28	560,015	12	....	....	20,553	34 34	705,914
Connecticut	34,554	80 56	2,773,670	88	....	....	133,195	34 73	4,626,310
New York	408,763	85 84	35,089,160	1,732	$104 22	$180,520	726,412	33 15	24,082,276
New Jersey	78,715	104 72	8,243,083	6,816	106 97	729,132	88,784	34 36	3,050,963
Pennsylvania	382,288	86 14	32,931,673	10,486	112 14	1,175,973	693,351	28 60	19,835,478
Maryland	78,620	81 43	6,402,796	9,599	99 10	951,279	128,469	24 31	3,123,536
Delaware	14,112	77 16	1,088,892	2,250	....	....	27,403	29 41	805,975
Kentucky	209,136	75 74	15,841,009	71,702	100 24	7,187,561	361,627	30 10	10,886,792
Ohio	520,497	73 76	38,396,820	7,539	100 88	760,558	748,979	24 16	18,099,793
Michigan	163,768	82 80	13,560,230	618	100 69	62,229	328,901	25 45	8,372,682
Indiana	358,692	77 77	27,899,426	19,535	98 62	1,925,660	546,558	22 29	12,187,105
Illinois	550,513	81 84	45,050,032	49,257	102 10	5,029,196	978,700	21 66	21,202,874
Missouri	217,943	76 90	16,960,151	49,645	102 66	5,096,953	471,006	19 21	9,051,787
Wisconsin	154,067	78 72	12,128,987	1,727	105 48	182,180	388,760	21 97	8,542,753
Iowa	307,923	84 78	26,108,409	12,206	106 84	1,304,163	561,338	22 87	12,840,703
Minnesota	31,782	85 39	2,713,959	659	109 27	72,013	127,175	21 66	2,742,569
Kansas	27,830	78 16	2,175,373	2,264	109 23	247,319	118,461	20 89	2,475,005
Nebraska Territory	9,687	85 79	831,085	1,130	121 90	137,752	53,606	26 46	1,418,918
Total	3,740,933	....	302,425,499	247,553	....	25,041,488	7,072,591	....	185,090,087
Average price	....	80 84	....	....	102 08	....	....	26 17	....

TABLE C—*Showing the total number and total value of each kind of live stock, &c.*—Continued.

STATES.	COWS.			SHEEP.			HOGS.		
	Total number.	Av'ge price.	Total value.	Total number.	Av'ge price.	Total value.	Total number.	Av'ge price.	Total value.
Maine	135, 059	$43 70	$5, 802, 078	905, 847	$5 44	$4, 936, 509	38, 221	$16 50	$630, 931
New Hampshire	77, 000	39 30	3, 026, 100	655, 714	5 44	3, 568, 724	32, 790	19 12	627, 101
Vermont	162, 356	43 11	6, 999, 167	1, 252, 089	5 98	7, 493, 753	32, 445	18 33	594, 795
Massachusetts	134, 121	52 50	7, 041, 352	201, 957	6 20	1, 262, 232	50, 611	18 99	961, 360
Rhode Island	21, 290	46 67	993, 604	32, 624	6 37	207, 896	12, 094	17 16	207, 600
Connecticut	109, 714	40 60	4, 454, 368	179, 343	6 08	1, 080, 541	52, 356	17 37	909, 685
New York	1, 220, 200	44 31	54, 067, 062	4, 576, 310	5 51	25, 226, 910	699, 983	14 13	9, 890, 762
New Jersey	135, 693	48 00	6, 513, 264	175, 256	6 23	1, 093, 159	183, 459	15 18	2, 785, 828
Pennsylvania	655, 397	39 22	25, 704, 470	2, 871, 503	5 62	16, 166, 561	829, 728	12 11	10, 048, 006
Maryland	94, 845	38 00	3, 604, 110	250, 072	7 01	1, 755, 505	328, 927	10 04	3, 302, 429
Delaware	19, 215	42 50	816, 637	17, 500	5 99	104, 999	32, 199	14 74	474, 854
Kentucky	172, 346	42 29	7, 288, 512	813, 400	5 52	4, 494, 035	1, 602, 284	6 88	11, 031, 725
Ohio	609, 799	35 13	21, 422, 238	5, 795, 340	5 49	31, 816, 417	1, 779, 176	9 26	16, 484, 065
Michigan	220, 825	32 27	7, 126, 022	3, 020, 066	5 20	15, 726, 995	339, 696	7 25	2, 463, 645
Indiana	445, 140	32 07	14, 596, 339	2, 455, 913	4 71	11, 579, 630	2, 025, 474	7 08	14, 355, 544
Illinois	551, 327	30 46	16, 793, 420	2, 062, 112	5 25	10, 841, 554	2, 034, 231	8 68	17, 662, 212
Missouri	272, 718	20 61	5, 620, 717	809, 565	3 77	3, 052, 060	988, 857	4 70	4, 650, 098
Wisconsin	270, 749	28 78	7, 792, 156	969, 925	5 74	5, 569, 795	340, 638	7 91	2, 695, 294
Iowa	294, 131	26 68	7, 847, 415	1, 466, 734	5 54	8, 136, 708	1, 423, 567	7 26	10, 335, 098
Minnesota	78, 768	26 35	2, 075, 537	64, 641	5 22	337, 750	109, 016	8 42	918, 187
Kansas	59, 998	26 66	1, 599, 546	60, 486	4 78	289, 386	102, 246	5 26	538, 036
Nebraska Territory	17, 439	30 63	534, 156	10, 872	6 10	66, 347	32, 889	6 93	228, 063
Total	5, 768, 130		211, 718, 270	28, 647, 269		154, 807, 466	13, 070, 887		111, 796, 318
Average price		36 70			5 40			8 55	

TABLE D,

Showing the total number and total value of each kind of live stock, and the average price thereof, for each State separately, as taken from the preceding general table.

Stock.	Number in January, 1865.	Average price.	Total value.	Stock.	Number in January, 1865.	Average price.	Total value.
MAINE.				NEW YORK.			
Horses	52, 147	$70 42	$3, 966, 269	Horses	408, 763	$85 84	$35, 089, 160
Mules	124	....	....	Mules	1, 732	104 22	180, 520
Cattle and oxen	172, 823	35 89	6, 203, 341	Cattle and oxen	726, 412	33 15	24, 082, 276
Cows	135, 059	43 70	5, 802, 078	Cows	1, 220, 200	44 31	54, 067, 062
Sheep	905, 847	5 44	4, 936, 509	Sheep	4, 576, 310	5 51	25, 226, 910
Hogs	38, 221	16 50	630, 931	Hogs	6[illegible]9, 983	14 13	9, 890, 762
Total	....	....	21, 539, 128	Total	....	....	148, 536, 690
NEW HAMPSHIRE.				NEW JERSEY.			
Horses	34, 404	66 37	2, 283, 616	Horses	78, 715	104 72	$8, 243, 083
Mules	10	....	....	Mules	6, 816	106 97	729, 132
Cattle and oxen	121, 521	33 36	4, 055, 081	Cattle and oxen	88, 784	34 36	3, 050, 963
Cows	77, 000	39 30	3, 026, 100	Cows	135, 693	48 00	6, 513, 264
Sheep	655, 714	5 44	3, 568, 724	Sheep	175, 256	6 23	1, 093, 159
Hogs	32, 790	19 12	627, 101	Hogs	183, 459	15 18	2, 785, 828
Total	....	....	13, 560, 612	Total	....	....	22, 415, 429
VERMONT.				PENNSYLVANIA.			
Horses	49, 920	75 18	3, 753, 338	Horses	382, 288	86 14	$32, 931, 673
Mules	35	....	....	Mules	10, 486	112 14	1, 175, 973
Cattle and oxen	152, 095	39 87	6, 064, 899	Cattle and oxen	693, 351	28 60	19, 835, 478
Cows	162, 356	43 11	6, 999, 167	Cows	655, 397	39 22	25, 704, 470
Sheep	1, 252, 089	5 98	7, 493, 753	Sheep	2, 871, 503	5 62	16, 166, 561
Hogs	32, 445	18 33	594, 795	Hogs	829, 728	12 11	10, 048, 006
Total	....	....	24, 905, 952	Total	....	....	105, 862, 161
MASSACHUSETTS.				MARYLAND.			
Horses	48, 509	78 75	3, 658, 506	Horses	78, 620	81 43	6, 402, 796
Mules	119	....	....	Mules	9, 599	99 10	951, 279
Cattle and oxen	122, 874	38 37	4, 715, 333	Cattle and oxen	128, 469	24 31	3, 123, 536
Cows	134, 121	52 50	7, 041, 352	Cows	94, 845	38 00	3, 604, 110
Sheep	201, 957	6 20	1, 262, 232	Sheep	250, 072	7 01	1, 755, 505
Hogs	50, 611	18 99	961, 360	Hogs	328, 927	10 04	3, 302, 429
Total	....	....	17, 638, 783	Total	....	....	19, 139, 655
RHODE ISLAND.				DELAWARE.			
Horses	7, 063	79 28	560, 015	Horses	14, 112	77 16	1, 088, 892
Mules	12	....	....	Mules	2, 250	Estim'd.	254, 250
Cattle and oxen	20, 553	34 34	705, 914	Cattle and oxen	27, 403	29 41	805, 975
Cows	21, 290	46 67	993, 604	Cows	19, 215	42 50	816, 637
Sheep	32, 624	6 37	207, 896	Sheep	17, 500	5 99	104, 999
Hogs	12, 094	17 16	207, 600	Hogs	32, 199	14 74	474, 854
Total	....	....	2, 675, 029	Total	....	....	3, 545, 607
CONNECTICUT.				KENTUCKY.			
Horses	34, 554	80 56	2, 773, 670	Horses	209, 136	75 74	15, 841, 009
Mules	88	....	....	Mules	71, 702	100 24	7, 187, 561
Cattle and oxen	133, 195	34 73	4, 626, 310	Cattle and oxen	361, 627	30 10	10, 886, 792
Cows	109, 714	40 60	4, 454, 368	Cows	172, 346	42 29	7, 288, 512
Sheep	179, 343	6 08	1, 080, 541	Sheep	813, 400	5 52	4, 494, 035
Hogs	52, 356	17 37	909, 685	Hogs	1, 602, 284	6 88	11, 031, 725
Total	....	....	13, 844, 574	Total	....	....	56, 729, 634

TABLE D—Continued.

Stock.	Number in January, 1865.	Average price.	Total value.
OHIO.			
Horses	520, 497	$73 76	$38, 396, 820
Mules	7, 539	100 88	760, 558
Cattle and oxen	748, 979	24 16	18, 099, 793
Cows	609, 799	35 13	21, 422, 238
Sheep	5, 795, 340	5 49	31, 816, 417
Hogs	1, 779, 176	9 26	16 484, 065
Total			126, 979, 891
MICHIGAN.			
Horses	163, 768	82 80	13, 560, 230
Mules	618	100 69	62, 229
Cattle and oxen	328, 901	25 45	8, 372, 682
Cows	220, 825	32 27	7, 126, 022
Sheep	3, 020, 066	5 20	15, 726, 995
Hogs	339, 696	7 25	2, 463, 645
Total			47, 311, 803
INDIANA.			
Horses	358, 692	77 77	27. 899, 426
Mules	19, 535	98 62	1, 925, 660
Cattle and oxen	546, 558	22 29	12, 187, 105
Cows	445, 140	32 07	14, 596. 339
Sheep	2. 455. 913	4 71	11, 579, 630
Hogs	2, 025, 474	7 08	14, 355, 544
Total			82, 543, 704
ILLINOIS.			
Horses	550, 513	81 84	45, 059, 032
Mules	49, 257	102 10	5. 029, 196
Cattle and oxen	978, 700	21 66	21. 202, 874
Cows	551, 327	30 46	16. 793, 420
Sheep	2, 062, 112	5 25	10. 841, 554
Hogs	2, 034, 231	8 68	17, 662, 212
Total			116, 588, 288
MISSOURI.			
Horses	217, 943	76 90	16, 960, 151
Mules	49, 645	102 66	5, 096, 953
Cattle and oxen	471, 006	19 21	9, 051, 787
Cows	272, 718	20 61	5, 620, 717
Sheep	809, 565	3 77	3, 052, 060
Hogs	988, 857	4 70	4, 650, 098
Total			44, 431, 766

Stock.	Number in January, 1865.	Average price.	Total value.
WISCONSIN.			
Horses	154, 067	$78 72	$12, 128, 987
Mules	1, 727	105 48	182, 180
Cattle and oxen	388, 760	21 97	8, 542, 753
Cows	270, 749	28 78	7, 792, 156
Sheep	969, 925	5 74	5, 569, 795
Hogs	340, 638	7 91	2, 695, 294
Total			36, 911, 165
IOWA.			
Horses	307, 923	84 78	26, 108, 409
Mules	12, 206	106 84	1, 304, 163
Cattle and oxen	561, 338	22 87	12, 840, 703
Cows	294, 131	26 68	7. 847. 415
Sheep	1, 466, 734	5 54	8, 136, 708
Hogs	1, 423, 567	7 26	10, 335, 098
Total			66, 572, 496
MINNESOTA.			
Horses	31, 782	85 39	2, 713, 959
Mules	659	109 27	72, 013
Cattle and oxen	127, 175	21 66	2, 742, 569
Cows	78, 768	26 35	2, 075, 537
Sheep	64, 641	5 22	337, 750
Hogs	109, 016	8 42	918, 187
Total			8, 860, 015
KANSAS.			
Horses	27, 830	78 16	2, 175, 373
Mules	2, 264	109 23	247, 313
Cattle and oxen	118, 461	20 89	2, 475, 005
Cows	59, 998	26 66	1, 599, 546
Sheep	60, 486	4 78	289, 386
Hogs	102, 246	5 26	538, 036
Total			7, 324, 659
NEBRASKA TER.			
Horses	9, 687	85 79	831, 085
Mules	1, 130	121 90	137, 752
Cattle and oxen	53, 606	26 46	1, 418, 918
Cows	17, 439	30 63	534, 156
Sheep	10, 872	6 10	66, 347
Hogs	32, 889	6 93	228, 063
Total			3, 216, 312

TABLE E,

Showing the total number of live stock for 1864 *and* 1865, *the increase and decrease thereof, the general average price of each kind, the value of each, and the total value.*

	1864.	1865.	Increase.	Decrease.
Horses	4,049,142	3,740,933	....	308,209
Mules	280,847	247,553	....	33,294
Cattle and oxen	7,965,439	7,072,591	....	892,848
Cows	6,066,748	5,768,130	....	298,618
Sheep	24,346,391	28,647,269	4,300,878	....
Hogs	16,148,712	13,070,887	....	3,077,825
Total	58,857,279	58,547,363	4,300,878	4,610,794

Number, average price, and total value for January, 1865.

	Number.	Average price.	Total value.
Horses	3,740,933	$80 84	$302,425,499
Mules	247,553	102 08	25,041,488
Cattle and oxen	7,072,591	26 17	185,090,087
Cows	5,768,130	36 70	211,718,270
Sheep	28,647,269	5 40	154,807,466
Hogs	13,070,887	8 55	111,796,318
Total	....	....	990,879,128

These tables show the value of the *live stock* of the farm to be $990,879,128. In the monthly report for February the value of the *crops* was placed at $1,504,543,690. Together, they make $2,495,422,818; but no one in his senses will regard that as the value of the personal property of the farm embraced in these tables, although both are often thus put together. They should rather be totally separated by deducting the value of the live stock from the crops; for no farmer can believe that live stock will more than repay the cost of their food at its market values during the year of 1864.

IMPORTS AND EXPORTS OF NEW YORK.

IMPORTS.

Year.	Dry goods.	Specie.	General merchandise.	Total imports.
1860	$103,927,100	$8,852,330	$125,481,030	$238,260,460
1861	43,636,689	37,088,413	81,043,688	162,768,790
1862	56,121,227	1,390,277	117,140,813	174,652,317
1863	67,274,547	1,525,811	118,814,219	187,614,577
1864	71,589,752	2,265,622	144,270,386	218,125,760
1865, 6 months of	24,624,166	....	54,918,054	79,542,220

EXPORTS.

Years.	Domestic produce.	Specie.	Foreign m'dse exported.	Total exports.
1860	$95,468,296	$42,191,171	$8,023,994	$145,683,451
1861	131,325,995	4,236,250	7,368,906	142,931,151
1862	149,179,591	59,437,021	7,755,231	216,371,843
1863	164,249,177	49,754,066	6,461,791	220,465,034
1864	201,855,989	50,825,621	19,966,553	272,648,163
1865, 6 months of	80,693,722	17,988,916	....	98,682,638

Shipment of specie from San Francisco.

[From the San Francisco Mercantile Gazette.]

Years.	East'n ports.	England.	China.	Panama.	Other ports.	Total.
1854	$46,533,166	$3,781,080	$965,887	$204,592	$560,908	$52,045,633
1855	38,730,564	5,182,156	889,675	231,207	128,129	45,161,731
1856	39,895,294	8,666,289	1,308,852	253,268	573,732	50,697,434
1857	35,531,778	9,347,743	2,993,264	410,929	692,978	48,976,692
1858	35,891,236	9,265,739	1,916,007	299,265	175,779	47,584,026
1859	40,146,437	3,910,930	3,100,756	279,949	202,390	47,640,462
1860	35,719,296	2,672,936	3,374,680	300,819	258,185	42,325,916
1861	32,628,011	4,061,779	3,541,279	349,769	95,920	40,676,758
1862	26,194,035	12,950,140	2,660,754	434,508	322,324	42,561,761
1863	10,389,330	28,467,256	4,206,370	2,503,296	505,667	46,071,920
1864	12,316,122	34,436,423	7,888,973	378,795	686,888	55,707,201
1865 6 m'hs	6,996,791	9,769,535	3,781,926	235,000	267,360	21,050,613
Total	360,972,060	132,519,006	36,628,423	5,881,397	4,470,260	540,464,147

Exports of specie from New York and San Francisco.

By deducting the amount of specie exported from San Francisco to the eastern ports from the total export, and adding to the remainder the specie exported from New York, we shall have a close approximation to the amount annually exported from New York and San Francisco, which will show, as nearly as we can, the export of specie from the United States.

Years.	Specie exported.	Gold received for custom duties.
1860	$48,797,791	....
1861	12,275,155	....
1862	75,804,747	$52,254,117
1863	85,436,656	56,943,454
1864	94,216,700	67,926,585
1865, 6 months of	32,042,738	36,856,702

THE NATIONAL DEBT.

The debt of the United States on the 31st day of July, 1865, the annual interest accruing thereon, and the entire interest on the whole debt, are as follows:

Debt bearing gold interest.

	Principal.	Interest.
Five per cent. bonds	$199,792,100 00	$9,989,605 00
Six per cent. bonds	908,870,541 80	54,532,232 50
Total bonds bearing coin interest	1,108,662,641 80	64,521,837 50

Debt bearing currency interest.

Four per cent. temporary loan	$646,936 56	$25,877 46
Five per cent. loan and notes	63,853,497 90	3,192,674 89
Six per cent. loans, certificates, and bonds	182,534,640 59	10,952,078 43
$7\frac{3}{10}$ treasury notes	830,000,000 00	60,590,000 00
Total	1,077,035,075 05	74,760,630 78

Debt on which the interest is not due for three years.

Six per cent. compound-interest notes	$212,121,470 00	$13,575,774 08

Debt on which interest has ceased.

Bonds and notes	$1,527,120 00

Debt, other than currency, drawing no interest.

Uncalled for requisitions and miscellaneous	$15,736,000 00

Debt bearing no interest, being currency.

Notes known as greenbacks	$433,160,569 00
Fractional currency	25,750,032 51
	458,910,601 51
Deduct from these coin and currency in the treasury	116,739,632 59
Currency debt	342,170,968 92

Recapitulation

	Principal.	Interest.
Debt bearing gold interest	$1,108,662,641 80	$64,521,837 50
Debt bearing currency interest	1,077,035,075 05	74,760,630 78
Debt on which interest is not due for three years	212,121,470 00	13,575,774 08
Total interest		152,858,242 36
Debt drawing no interest, not being currency	$17,263,120 09	
Debt bearing no interest, being currency	342,170,968 92	
Total debt	2,757,253,275 86	

From this table it will be seen that the annual interest accruing on the amount of the national debt as it was on the 31st day of July last is $152,858,242 36, but of which $13,575,774 08 are not payable until the expiration of three years, when both principal and the three years' accumulated interest thereon will become due. We learn that these compound interest notes, or a portion of them, will be converted into bonds, under the act authorizing their issue.

The amount of the United States currency July 31, 1865.

Five per cent. notes	$39,954,230	00
Six per cent. compound interest notes	212,121,470	00
Greenbacks not bearing interest	433,150,569	00
Fractional currency	25,750,032	51
	710,976,301	51
National banks' circulation	157,907,665	00
Supposed amount of State banks' circulation	80,000,000	00
Total circulation	948,883,966	51

Revenues of the government for the fiscal year ending June 30, 1864.

From internal taxes as follows:

On manufacturers and their productions	$75,403,386	60
On slaughtered animals	695,201	68
On advertisements, ferries, express companies, &c	2,895,998	63
For licenses	7,145,388	71
On incomes	14,919,279	58
On legacies	310,836	18
On carriages, billiard tables, yachts, plate, &c	520,283	35
For penalties, &c	185,224	94
On sales, &c	138,082	43
For passports	483	00
On banks, insurance, railroad, canal, and turnpike companies	7,017,547	03
On salaries	1,705,124	63
For stamps	5,894,945	14
Sundries	18,890	54
	116,550,672	45
Deduct expenses, salaries, &c., of assessors and collectors	5,528,884	60
Net total	111,021,787	85
Net amount collected	108,469,922	62
Amount not paid over	2,551,865	23

The chief revenues of the government, being from internal taxes and customs, were for 1864 as follows:

Payable in currency, internal taxes	$108,469,922	62
Payable in coin, customs	67,926,585	00
Total	176,396,507	62

Total annual interest on debt, July 31, 1865	$152,858,242	36

The taxes on manufactures.

As the internal taxes on manufacturers and their productions are the most important, and will give rise to much legislation, in which conflicting interests

will press heavily against that equality on which all classes and occupations should be placed, we give the following interesting table taken from *Hunt's Merchants' Magazine*, showing the taxes collected in 1864 from the principal manufactures of the country, and the proportion of them paid by each State.

The *amounts collected* and the *value of the manufactures* assessed are shown in the following table:

States.	Total taxation.	Value taxed at 3 per cent.	Rank as manufacturing State.
Maine	$888,858 47	$29,628,616	14
New Hampshire	833,118 44	27,770,615	15
Vermont	231,680 82	7,722,694	23
Massachusetts	8,277,863 02	275,928,767	5
Rhode Island	1,380,393 76	46,013,125	13
Connecticut	2,273,355 60	75,778,520	9
New England States	13,885,270 11	462,842,337	
New York	$16,851,113 01	$561,703,767	1
New Jersey	2,073,529 12	69,117,637	10
Pennsylvania	9,618,462 22	320,615,407	2
Delaware	259,952 41	8,665,080	21
Maryland	1,848,620 94	61,620,698	12
District of Columbia	71,341 33	2,378,044	24
Virginia	18,955 52	631,851	27
Atlantic States, &c.	30,741,974 55	1,024,732,485	
West Virginia	$248,375 90	$8,279,197	22
Kentucky	3,061,943 06	102,064,769	6
Missouri	2,413,521 93	80,450,731	8
Tennessee	517,073 84	17,235,795	19
Louisiana	1,942,894 04	64,763,134	11
Southern Interior States	8,183,808 77	272,793,626	
Ohio	$9,458,937 95	$315,297,932	3
Indiana	2,556,048 95	85,201,632	7
Illinois	8,389,496 02	279,649,867	4
Michigan	762,669 51	25,422,317	16
Wisconsin	603,909 78	20,130,326	17
Iowa	369,326 79	12,310,893	20
Minnesota	24,554 87	118,496	25
Kansas	16,039 21	534,640	28
Nebraska	3,949 25	131,642	33
Northern Interior States	22,184,932 33	739,497,744	
California	$589,330 24	$19,644,574	18
Oregon	23,969 65	798,988	26
New Mexico	236 20	7,873	34
Utah	6,263 25	208,775	30
Colorado	5,542 64	184,755	31
Nevada	11,516 09	383,869	29
Washington	4,465 74	148,858	32
Pacific States	641,330 81	21,377,693	

RECAPITULATION.

States.	Total taxation.	Value taxed at 3 per cent.	Rank as manufacturing State.
Six New England States	$13,885,270 11	$462,842,337	3
Six Atlantic States and D. C.	30,741,974 55	1,024,732,485	1
Five Southern Interior States, &c.	8,183,808 77	272,793,626	4
Nine Northern Interior States, &c.	22,184,932 33	739,497,744	2
Seven Pacific States, &c.	641,330 81	21,377,693	5
Aggregate	75,637,316 57	2,521,243,885	....

The articles yielding the principal part of the foregoing taxes are as follows:

CIGARS		$1,255,424 89
New York	$456,461 47	
Pennsylvania	292,784 07	
COAL		572,436 54
Pennsylvania	437,192 68	
Ohio	46,364 34	
Illinois	32,385 26	
Maryland	27,554 43	
CONFECTIONERY		465,793 15
New York	109,303 26	
Illinois	67,754 43	
Ohio	58,602 77	
Pennsylvania	57,205 37	
Massachusetts	46,990 36	
COTTON, (raw)		1,268,412 56
Tennessee	488,325 80	
Louisiana	436,044 52	
Ohio	94,086 59	
Kentucky	83,050 15	
Pennsylvania	57,895 38	
COTTON GOODS		3,548,176 51
Massachusetts	1,128,928 77	
Rhode Island	593,040 53	
Maine	350,546 71	
New York	315,000 67	
Pennsylvania	310,554 92	
Connecticut	306,426 18	
Maryland	127,522 86	
DISTILLED SPIRITS		28,431,797 83
Illinois	7,262,433 15	
Ohio	6,442,408 03	
New York	5,986,255 30	
Pennsylvania	2,194,425 94	
Indiana	2,084,402 06	
Kentucky	1,157,364 13	
FERMENTED LIQUORS		2,223,719 73
New York	780,255 78	
Pennsylvania	310,287 98	
Ohio	209,685 97	
Illinois	155,590 21	

Missouri	$112,428 11	
Massachusetts	97,831 59	
GAS		$714,740 13
New York	297,330 24	
Pennsylvania	124,995 53	
Massachusetts	67,274 05	
Ohio	36,105 92	
Louisiana	27,549 64	
Illinois	27,525 33	
Maryland	26,889 64	
California	16,117 14	
District of Columbia	15,809 53	
Missouri	15,702 80	
IRON MANUFACTURES		3,202,855 14
Pennsylvania	944,094 93	
New York	557,603 97	
Massachusetts	471,459 25	
New Jersey	278,475 64	
Connecticut	242,745 51	
Ohio	199,158 53	
LEATHER		3,717,433 87
Massachusetts	1,615,158 53	
New York	715,835 16	
Pennsylvania	422,949 14	
MATERIAL, MANUFACTURE OF, (not otherwise provided for)		6,285,076 32
New York	2,232,165 07	
Massachusetts	1,131,506 85	
Pennsylvania	1,028,458 35	
OIL, (petroleum)		2,201,573 20
Pennsylvania	1,334,997 38	
New York	241,863 44	
Ohio	241,013 46	
Massachusetts	206,291 51	
PAPER, and MANUFACTURES OF		911,914 72
New York	240,447 71	
Massachusetts	226,678 60	
Pennsylvania	119,930 25	
Connecticut	83,763 35	
Ohio	54,269 59	
SUGAR, (raw)		1,267,616 28
Louisiana	1,257,195 37	
SUGAR, (refined)		873,139 85
New York	464,779 68	
Pennsylvania	124,587 90	
Massachusetts	81,339 43	
Maryland	56,037 93	
TOBACCO, MANUFACTURES OF		7,086,684 74
New York	1,558,086 20	
Kentucky	1,744,714 81	
Missouri	1,329,258 51	
Ohio	716,567 89	
Pennsylvania	360,568 99	
Michigan	287,007 49	
Illinois	333,450 91	
Indiana	131,857 67	
WOOD-WARES		1,679,940 25

New York	$413,132 27	
Ohio	263,445 77	
Pennsylvania	187,905 01	
Massachusetts	183,740 86	
Illinois	120,577 87	
WOOL, MANUFACTURES OF		$3,647,246 61
Massachusetts	1,191,177 91	
Pennsylvania	495,739 12	
Connecticut	473,630 86	
New York	390,949 48	
Rhode Island	318,950 58	

EXPORTS AND PRICES OF FARM PRODUCE.

Exports from New York of the leading agricultural products from January 1, 1864, *to December* 28, 1864, *compared with those for the same time in* 1863, *and their prices in New York and Chicago on the* 27*th day of December*, 1864.

Articles.	1864.	1863.	Prices 27th December in New York.	Prices in Chicago.
Wheat flour..........bbls..	1,918,593	2,527,338	$9 45 to $12 00	$6 00 to $11 25
Rye flour..........bbls..	2,840	5,461	8 75 to 9 25	7 00 to 7 25
Cornmeal..........bbls..	105,142	140,561	8 75 to 8 80	....
Wheat..........bush..	12,195,433	15,424,889	2 18 to 2 85	1 54 to 1 78
Corn..........bush..	846,831	7,533,431	1 76 to 1 86	88 to 95
Rye..........bush..	588	416,369	1 70 to 2 05	1 10 to 1 20
Barley..........bush..	150	52,439	2 08	1 55
Oats..........bush..	42,125	126,556	98 to 1 06	65 to 66
Peas..........bush..	186,159	110,911	....	....
Cotton..........bales..	26,765	13,945	1 15 per lb.	....
Hay..........bales..	40,325	19,986	1 40 to 1 90	80 to 1 10
Hops..........bales..	22,077	25,409	30 to 50	33 to 55
Leaf tobacco..........hhds..	90,559	59,744	10½ to 32	....
Leaf tobacco..........pkgs..	70,845	47,695	....	....
Manufact'd tobacco..lbs..	5,350,014	3,542,210	....	65 to 1 50
Petroleum..........galls..	21,359,629	....	70	....
Pork..........bbls..	130,672	192,903	39 25 to 41 50	35 00 to 37 00
Beef..........bbls..	36,548	41,632	19 00 to 24 00	16 00 to 20 00
Beef..........tierces..	49,299	62,868	....	....
Cut meats..........lbs..	93,600,258	183,519,060	17¼ to 21	15 to 18
Butter..........lbs..	14,174,861	23,060,793	38 to 60	30 to 48
Cheese..........lbs..	49,755,842	40,781,168	15 to 24	18 to 24
Lard..........lbs..	53,436,128	120,881,862	20 to 24½	21 to 21½
Tallow..........lbs..	31,987,976	43,487,731	16½ to 17½	....
Wool, (fleece)..........lbs..	....	....	85 to 1 05	80 to 85

Exports from New York of the leading agricultural products from January 1, 1865, *to July* 5, *compared with those for the same time in* 1864, *and their prices in New York and Chicago on the 5th of July.*

Articles.	From January 1, 1865, to July 5.	From January 1, 1864, to July 5.	Prices July 5, 1865—New York.	Prices July 6, 1865—Chicago.
Wheat flour .... bbls..	679,124	1,042,874	\$5 00 to \$7 65	\$4 12½ to \$8 75
Rye flour .... bbls..	1,408	2,103	5 30 to 5 60	4 50 to 4 75
Corn meal .... bbls..	75,542	65,506	4 50 to 5 15	....
Wheat .... bush..	480,001	7,541,990	1 26 to 1 44	86½ to 1 07
Corn .... bush..	382,853	155,403	70 to 80	46 to 53½
Rye .... bush..	141	405	....	51 to 54
Barley .... bush..	....	150	....	55
Oats .... bush..	45,637	22,201	69 to 70	38 to 42½
Peas .... bush..	24,462	140,411	1 00 to 1 30	....
Cotton .... bales..	21,769	22,615	32 to 50	....
Hay .... bales..	18,145	17,428	95 per 100 lbs.	80 to 90
Hops .... bales..	12,877	15,575	10 to 30	25 to 35
Leaf tobacco .... hhds..	34,500	25,415	8½ to 22	....
Leaf tobacco .... pkgs..	39,242	39,598	....	....
Manufact'd tobacco.. lbs..	2,174,215	2,101,742	....	60 to 1 25
Petroleum .... galls..	4,005,689	7,690,396	52½	....
Pork .... bbls..	70,553	82,656	23 25 to 26 00	24 00 to 26 00
Beef .... bbls..	21,872	21,327	10 00 to 16 00	8 00 to 14 00
Beef .... tierces..	34,437	39,338	....	....
Cut meats .... lbs..	26,153,095	80,964,830	12 to 20	12 to 16½
Butter .... lbs..	7,583,060	5,956,373	20 to 22	....
Cheese .... lbs..	14,039,594	14,896,807	10 to 15	12 to 17
Lard .... lbs..	16,047,833	33,744,011	15½ to 19½	17 to 18
Tallow .... lbs..	12,411,477	21,135,148	10 to 11¼	....
Wool, (fleece) .... lbs..	....	....	55 to 75	43 to 50

COMMENTS.—The above tables exhibit the decreased exports of our leading agricultural productions. The falling off in wheat and flour is remarkable, and indicates the low prices in Great Britain. Beef and pork have attained such high rates here that a decreased exportation was to have been expected; yet the decrease, though great in cut meats, is not at all in proportion to that of these breadstuffs. Petroleum has decreased nearly one-half, for Europeans are finding it for themselves, and the speculation in coal-oil lands is rapidly subsiding here.

With such a decreased export trade as is seen in this table let farmers beware of credits at the stores. *Individual and national economy were never more demanded than now.*

Table showing the value of the currency.

The prices given in the preceding table are those established by the currency, and not by the standard of gold values; hence the following table, showing the difference between gold and currency, is necessary to fully understand the table of prices.

		1862.	1863.	1864.	1865.			1862.	1863.	1864.	1865.
January	2	112	135	152	228	July	2	119	144	237	......
	9	115	138	152	226		9	116	131	275	......
	16	112	146	155	220		16	116	126	253	......
	23	113	147	158	200		23	119	126	254	......
	30	113	157	157	213		30	114	127	256	......
February	6	113	157	159	213	August	6	114	127	260	......
	13	114	155	159	206		13	114	127	255	......
	20	113	163	161	200		20	115	124	257	......
	27	112	171	161	200		27	115	124	249	......
March	5	112	155	162	198	September	5	119	131	239	......
	12	111	161	162	188		12	119	129	220	......
	19	111	155	162	164		19	117	135	225	......
	26	111	139	170	154		26	120	139	191	......
April	2	112	153	168	147	October	2	123	142	190	......
	9	111	147	171	144		9	127	147	198	......
	16	111	154	180	151		16	133	153	220	......
	23	111	150	179	151		23	132	146	214	......
	30	112	150	180	146		30	130	146	224	......
May	7	112	155	172	141	November	7	131	147	242	......
	14	113	150	172	130		14	131	147	245	......
	21	113	150	183	130		21	130	153	219	......
	28	114	143	186	136		28	129	146	230	......
June	4	113	146	191	136	December	4	133	152	228	......
	11	114	142	199	141		11	132	152	235	......
	18	115	144	196	142		18	132	152	215	......
	25	118	145	220	141		25	133	152	217	......

Capital invested in, and the annual profits of, the industrial pursuits.

R. G. Dunn & Co., of the mercantile agency of New York, have compiled the following table, showing the number of business firms and their capital in mercantile, manufacturing, and trading operations in 1864.

In publishing this table, they say:

"The deep interest we have felt in arriving at correct statistics, to submit to the judgment of our subscribers, has induced us to make the most rigid and careful research of our records, at this particular juncture, in order to present to them, at a glance, an estimate of the wealth of the mercantile, manufacturing, and trading interests in the loyal States. This estimate is not obtained by averaging the whole number of traders, but by a specific examination of each name or firm. It has been the work of months, both with us and our associate officers throughout the country, and the result is shown in the appended table, arranged by States and the principal cities. The States of Missouri, Kentucky, Louisiana, and Kansas having been made the theatre of war, thereby disorganizing trade, are consequently not fully represented in this estimate; and California, as it will be observed, is entirely omitted. Still, without them, the aggregate shows 168,925 business houses, representing a wealth of $4,944,766,000, mostly invested in personal property. It is generally conceded that the average profits of trade range from twelve to fifteen per cent.; but assuming the low figures of ten per cent., we have $494,476,000 as the accrued gain the past year,

on the business interests spoken of. This, in view of the unprecedented expenditure necessarily incurred, both by heavy taxation and in otherwise sustaining the government, exhibits the self-supporting character of our people, and but one element of the strength of the country, which, when added to the other immense resources not brought into our estimate, such as real estate, agricultural, mining, and other interests, should inspire the most hopeful confidence in our future growth and permanent prosperity.

Mercantile, manufacturing, and trading wealth and profits for 1864.

Connecticut	5, 832	$145, 588, 000
Delaware	1, 150	24, 701, 000
District of Columbia	1, 282	17, 448, 000
Illinois	12, 215	207, 508, 000
Indiana	8, 512	134, 240, 000
Iowa	5, 052	38, 532, 000
Kansas*	438	3, 357, 000
Kentucky*	1, 528	39, 559, 000
Louisiana,* (New Orleans only)	802	50, 794, 000
Maine	4, 982	99, 293, 000
Maryland	3, 665	102, 359, 000
Massachusetts	17, 302	868, 815, 000
Michigan	5, 934	83, 943, 000
Missouri*	3, 263	81, 334, 000
Minnesota	979	7, 602, 000
New Hampshire	2, 851	38, 685, 000
New Jersey	5, 910	90, 250, 000
New York	36, 932	1, 677, 204, 000
Ohio	17, 005	310, 725, 000
Pennsylvania	22, 941	733, 296, 000
Rhode Island	2, 487	115, 704, 000
Vermont	2, 494	19, 989, 000
Wisconsin	5, 369	53, 775, 000
Total	168, 925	4, 944, 766, 000

We add to the above table the following, in order to give with it the capital invested, and the annual profits for 1864 of agriculture, in the loyal States.

By the census of 1860 the value of farms and of agricultural implements employed on these farms in these States, including Nebraska Territory, was $4,879,691,097. The increase in the value of farming lands since 1860 has been small in comparison to that of personal property; but regarding it at 16⅔ per cent., and that of agricultural implements at 25 per cent., then the above value of both would be increased in 1864 to $5,706,141,998.

The net profits of the farm, ordinarily, do not exceed 5 per cent. on these investments; but under the past high prices it may safely be put at 10 per cent. for 1864. These profits would then be $570,614,199.

Thus estimated, a table of the capital and profits for 1864, of these pursuits, would be as follows:

Capital of manufactures and commerce	$4, 944, 766, 000
Capital of agriculture	5, 706, 141, 998
Profits for 1864, of manufactures, &c	494, 476, 600
Profits for 1864, of agriculture	570, 614, 199
Total capital	10, 650, 907, 998
Total profits	1, 065, 090, 799

By reference to the value of the leading crops in 1864, as given in the preceding table, and adding nothing thereto for the value of farm stock, because of the amount of these crops consumed by them, we have—

Value of these crops for 1864	$1,504,543,690
Add for butter, cheese, fruits and vegetables, &c	140,000,000
	1,644,543,690
Deduct net profits as above	570,614,199
Cost of production	1,073,929,491

Imports of foreign wool at New York during the years 1863 *and* 1864, *and for six months of* 1865.

	1863.		1864.		1865, (six months.)	
	Weight.	Entered.	Weight.	Entered.	Weight.	Entered.
	Pounds.	*Value.*	*Pounds.*	*Value.*	*Pounds.*	*Value.*
England	11,426,648	$2,013,770	6,551,586	$1,312,317	1,235,972	$304,877
Buenos Ayres	12,203,407	1,819,690	11,582,990	1,780,496	8,183,394	1,047,117
France	7,075,227	1,223,543	5,837,840	1,080,041	596,432	103,227
Belgium	1,403,108	255,279	1,005,840	264,840	....	....
Africa	4,964,345	822,002	10,973,155	2,007,742	2,132,067	381,925
Brazil	1,135,073	168,777	1,306,529	219,311	426,686	56,438
Sardinia	24,020	2,963	....	....	....	....
Venezuela	550	58	....	....	....	....
Tuscany	243,318	30,874	150,331	15,680	....	....
British N. American Colonies	3,206	955	....	....	....	....
Bremen	183,032	60,658	96,396	24,799	....	....
New Grenada	56,449	9,086	6,362,122	547,562	1,105,262	240,301
Scotland	7,300	2,679	....	....	....	....
Wrecked	19,317	2,935	....	....	....	....
Spain	191,625	30,463	137,324	22,710	....	....
Canary Islands	1,724	1,734	....	....	....	....
Italy	....	....	26,299	5,124	....	....
Hamburg	169,055	49,331	281,041	38,847	78,018	9,280
Gibraltar	48,639	7,945	83,699	14,316	....	....
Cuba	5,869	894	....	....	....	....
Portugal	180,354	30,227	175,889	29,281	....	....
British West Indies	907	139	316,059	42,529	652	63
Porto Rico	....	....	128,438	17,616	....	....
Turkey	1,117,552	185,004	537,884	113,803	4,180	216
Dutch West Indies	34,739	4,241	15,932	1,953	1,262	120
Mexico	1,314,209	176,024	460,599	60,562	210,577	25,959
Cisplatine Republic	1,058,392	172,221	3,409,672	613,844	150,595	13,421
Russia	1,387,479	217,743	3,505,189	600,343	2,217,113	322,501
British East Indies	703,084	146,598	1,247,396	233,730	12,706	3,241
British Possessions in Africa	2,915,994	526,012	518,954	93,892	....	....
Chili	757,445	143,643	1,539,795	194,849	439,145	49,420
Cadiz	30,649	5,354	....	....	....	....
Malta	2,772	666	....	....	....	....
China	79,213	9,514	4,800	439	906	125
Austria	....	....	27,045	7,527	....	....
Morocco	....	....	356,133	47,296	....	....
Danish West Indies	....	....	4,436	512	2,582	290
Greece	....	....	230,755	26,330	4,097	462
Australia	....	....	....	....	403,631	77,732
Total	48,744,901	8,121,032	56,874,128	9,418,291	17,205,277	2,636,715

These values are in gold, and represent the foreign cost.

Wool product of California.

Year.	Pounds.	Increase per cent.		PRICES IN 1864.	
				Spring wool.	Fall wool.
1855	360,000	......	......	......	......
1856	600,000	66	Merino	23 to 25	17 to 18
1857	1,100,000	83	Half Merino	21 to 23	17 to 18
1858	1,428,000	30	American	19 to 21	16 to 17
1859	2,378,000	66	Half American	18 to 19	15 to 16
1860	3,260,000	37	Mixed	15 to 18	14 to 15
1861	4,600,000	41	Burry	13 to 15	10 to 13½
1862	6,400,000	40	......	......	......
1863	7,600,000	19	......	......	......
1864	8,000,000	5	......	......	......

Of the crop of 1864 there was shipped to New York	5,491,814	pounds.
Do.........do.........do.......Boston	842,850	"
Total to Atlantic States	6,334,664	"

Wool product of the Atlantic loyal States.

Years.	Number of sheep.	Amount of wool.	Yield per sheep.
		Pounds.	*Pounds.*
1840	15,782,551	......	......
1850	16,777,468	44,460,290	2.65
1860	17,198,219	51,766,639	3.01
1862	18,880,340	66,081,190	3.50
1864, (January)	24,346,391	91,298,965	3.75
1865, (January)	28,647,269	114,589,076	4.00

Total wool consumed in loyal States, as above given, in 1864.

Wool grown in the loyal Atlantic States	91,298,965	pounds.
Wool grown in California	8,000,000	"
Wool imported into New York	56,874,128	"
Total	156,173,093	"

LIVE STOCK FOR FOOD.

Live stock received at New York for the years 1862, 1863, *and* 1864.

Years.	Beeves.	Milch cows.	Veals.	Sheep & lambs	Swine.
1862	231,402	5,221	36,619	461,105	1,116,044
1863	268,860	6,731	36,122	516,972	1,693,138
1864	268,599	7,573	78,571	796,379	659,954

The following table shows the States from which the beeves have been received:

	1862.	1863.	1864.
New York	35,958	28,928	40,202
Illinois	101,742	117,638	93,789
Indiana	16,555	14,040	8,091
Iowa	3,707	8,455	3,606
Virginia	117	85	98
Connecticut	410	460	688
Massachusetts	....	36	348
Wisconsin	....	59	126
Ohio	30,635	19,688	23,288
Kentucky	9,669	7,682	9,245
Michigan	7,225	9,054	12,424
Pennsylvania	1,550	746	940
Missouri	1,729	1,575	2,835
New Jersey	411	195	352
Canada	523	686	2,979
New Hampshire	....	....	11
Kansas	....	....	149

Yearly average prices.

	1862.	1863.	1864.
Beeves, per pound	\$0 07¾	\$0 09½	\$0 13
Cows, per head	34 40	41 00	60 00
Veals, per pound	5½	6	9¼
Sheep and lambs, per head	4 43	5 89	8 per lb.
Swine, per pound	5	5	12½

CALIFORNIA WINES.

The following are the imports and exports of wines at San Francisco in 1863 and 1864, taken from the Mercantile Gazette of that city:

	IMPORTS.			EXPORTS.	
	1863.	1864.		1863.	1864.
Hogsheads	20	572	Pipes and casks	856	1,485
Pipes	21	31	Half-casks	92	96
Casks (60 gallons)	5,444	7,191	Quarter-casks	71	42
Half-casks	830	1,757	Barrels	151	147
Quarter-casks	1,000	2,534	Octaves	128	40
Barrels	72	595	Kegs	69	53
Octaves	432	1,188	Cases	8,994	9,481
Baskets	31,257	48,574	Baskets	2,235	2,614
Cases	48,640	65,217	Packages	23	317

The imports have evidently increased much more than the exports, and hence, even for California consumption, the home market invites to an increased wine production. The assurance which the act of Congress has given, by its increased duties on foreign wines, that the home market will be at the command of the home production, is infusing a greatly increased vigor in vine-planting in

California. The fact, too, that it is a crop that will seldom be much injured by the occasional extreme droughts of the California climate, and that its habitual dryness during the summer is highly advantageous, will also give an additional stimulant to grape cultivation. The lesson taught by the recent drought, that thorough farming is the safest, and to be thorough it must be limited to small farms, will also aid this crop. With these motives to the full development of the great natural advantages that California has as a wine-producing country, we may anticipate such an advance as will make it the great wine country of the world; and as this advance progresses, to draw such attention as will increase correspondingly the demand for its wines.

REPORT OF THE SUPERINTENDENT OF THE EXPERIMENTAL GARDEN.

SIR: In presenting my annual report of progress in the garden, I beg to call attention to the fact that operations instituted with a view of testing the merits of products must, necessarily, be slow; time must elapse between the period of planting and that of maturity, varying, of course, with the nature of the plant; and when it is kept in mind that the collection was commenced so lately as the spring of 1863, it will be readily understood that no extensive experiments can yet be sufficiently matured to warrant an exposition claiming to be a just criteterion of the comparative value of individual kinds.

With regard to the value of such discriminating tests, it has been remarked that observations obtained in this garden may be of but little benefit and of very doubtful application in other and distant localities. Although not sharing in this opinion to the extent of that held by some, it is yet, to a certain degree, a truthful one; still, it cannot lessen the value of observations made here, neither does it prove that there is no necessity for them; it does, however, suggest the importance of establishing experimental grounds in various localities, under the auspices of State and local agricultural and horticultural societies. Such gardens would be valuable appendages to agricultural colleges, presenting attractive and interesting studies, and collecting facts of great local as well as of general value.

PEARS.

In previous reports allusion has been made to the limited capacity of the grounds controlled by this department; this entirely precludes attempts to establish permanent specimen orchards of cultivated fruits. In the report of 1862 mention was made of planting a small collection of pears in the fall of that year, equal portions of dwarfs and standards. Since then an additional plantation has been made of about one hundred varieties, all on quince stocks. The first plantation has progressed favorably, and, so far, has strengthened the opinion, now held by many persons who have given the subject close attention, that pears, grafted on pear stocks, may be so managed as to produce fruit as early and as abundantly as those grafted on quince roots; no one questions the greater permanence of the pear root and its yearly increasing capability of production. Of those, so far as tried here, the most precocious on the pear are the Howell, Buffum, Beurre Giffard, Bartlett, Beurre Clairgeau, Belle Lucrative, and Dearborn's Seedling. In mentioning these, it is not asserted that there are not other varieties equally valuable in this respect, but so far, the above-named sorts have here produced more fruit than their respective duplicates on the quince. The trees were of the same age when planted, soil and locality alike, and where all exhibit a healthy and even luxuriant growth.

It may be well to remark that these trees have had no particular treatment, except that they have not been pruned since they were planted. They were then pruned quite closely, and a few of the strongest shoots were pinched during the first summer, in order to maintain uniformity of growth; but no further pruning has been given. There is no doubt that the constantly recurring winter pruning that many fruit trees receive retards their early fruiting, by encouraging strong yearly growths that never develop fruiting buds. Several of the trees, both standard and dwarf, have been destroyed by what is termed blight. In holding a *post-mortem* examination over these unfortunates, it was observed that the stock upon which they were grafted had not grown in the same ratio as the scion; in some cases, the difference in diameter was nearly doubled in favor of the graft. This may or may not have had an inflnence in their sudden decease, but the circumstance was so marked in each fatal case as to be worthy of record.

STRAWBERRIES.

Since last report the following varieties have been added to the collection:

Agriculturist,
Athlete,
Ajax,
Burlington Beauty,
Brooklyn Scarlet,
Colonel Ellsworth,
Crimson Queen,
Chorlton's Prolific,
Comte de Flanders,
Chilian Pyramidal,
Ladies' Pine,
La Reine,
Lennig's White,
Mead's Seedling,
Monitor,
Queen Victoria,
Randolph Pine.
Schiller,
Scarlet Magnate,
Victoria Seedling,

and a few seedling varieties not yet named.

The following notes have been taken of those that have fruited here in sufficient quantities and under conditions to warrant an opinion. Taking the figure 6 as a standard of excellence, we place them relatively thus:

Name of variety.	Quality.	Quantity.	Name of variety.	Quality.	Quantity.
Burrs New Pine	5	4	McAvoy's Superior	4	4
Cutter's Seedling	3	4	May Queen	4	4
Carolina Superb	6	1	Oscar	6	2
Duc de Brabant	5	4	Pineapple	5	2
Downer's Prolific	3	5	River's Seedling Eliza	6	5
Excellente	6	2	Reine Hortense	4	4
Fillmore	4	4	Stirling Castle Pine	5	3
Golden Seeded	5	4	Sir C. Napier	5	3
Great Austin	4	4	Triomphe de Gand	5	5
Hooker	6	3	Trollope's Victoria	4	4
Jenny Lind	4	4	Vicomptesse de Thury	5	4
Jucunda	4	6	Wilson's Albany	3	6
Lady Finger	4	5	Wizard of the North	3	4
La Tour de Mauborg	5	4			

In comparing these results it must be kept in view that no fruit varies so materially, both in flavor and productiveness in different soils and climates, as the strawberry. Even in the same soil and locality the yearly result will not always be the same. The quantity will be influenced by the state of the weather when the plants are in flower, and the flavor of the fruit is almost as sensitive to wet as a barometer. In all cases the crop will be increased by slight covering during winter, thus saving the earliest-formed buds, which otherwise are liable to be destroyed by frosts.

Again: injury often results from disturbing the roots at improper periods. It is particularly hurtful to dig or plough between the plants in spring before the crop is matured. In some soils, if properly prepared previous to planting, nothing will be required, in the way of cultivation, except keeping clear of weeds for two or three years. Soils that are somewhat tenacious frequently become consolidated if trampled on while wet during the gathering of the crop. In this case it should be loosened up with fork or cultivator as soon as possible after the fruit is past, and kept clean and friable during the season. The roots that support the flower buds are formed during the end of summer and fall, and any injury they receive will correspondingly injure the crop. It is now well known that good crops of fruit cannot be had if the runners are not removed during summer.

GOOSEBERRIES.

The finer varieties of this fruit are so frequently destroyed by mildew that their culture is but limited and very unsatisfactory. A small plantation here has fruited in great perfection for several years without showing any indication of disease. No special culture has been given. The location is rather sheltered, and they are planted in a border on the north side of a picket fence, but not shaded. About one-half of the summer's growth is removed in the fall, and the soil is covered with stable manure before winter. The roots are never disturbed, no digging being allowed; the soil is not cultivated, except merely to keep the surface from being overrun with weeds.

The kinds are: Abraham Newland, Bunker's Hill, China Orange, Green Gage, Governess, Glory of Ratcliffe, Green Prolific, Keepsake, Patterson Seedling, Royal Ordinance, Miss Walton, Washington Seedling, and Trafalgar.

ORCHARD-HOUSE.

In my last report allusion was made to a plantation of nectarines, peaches, &c., set in a shallow bed of soil instead of pots, as is usual in this mode of culture. These have produced abundantly, and the growth is completely under control, proving beyond doubt that this mode can be relied upon, and avoiding the risk and expense of pot culture.

GRAPES.

The following list of grapes has been discarded, none of them being worthy of further attention:

Albino.	Jacobi.
Brandywine.	Ketchum.
Blood's White and Black.	New Buda.
Beansville.	Old House.
Coppermine.	Otoe.
Cheowa.	Purple Favorite.
Clappier.	Powell.
Cairnano.	Red River.
Hiawasse.	Traminer.

Undoubtedly there are many others on the long list of varieties that must sooner or later follow the above. Unfortunately, the rage at present seems to be the possession of a *large collection*, rather than a *choice selection* of the best. It is argued in favor of large collections that by that means sorts adapted to various localities will be determined. This truth no one will deny; it is a well-established fact that some varieties will do better in certain localities than others, but the laws governing these changes are pretty well understood, and it

does not seem at all necessary that every new beginner should commence his experiments at the same point; it is the part of wisdom to take advantage of the experience of others, and recognize the teachings of those who have devoted time and means to the subject.

The Yeddo grape, received from Japan, proves to be so liable to mildew as to render it unfitted for out-door culture here. Young plants in open exposures invariably lose their foliage by midsummer, and occasionally the plants are killed before winter. Of those that survive until the following spring, few have sufficient vigor to make even a feeble growth before they are again attacked by mildew. Under a protected trellis the foliage has remained healthy, and the shoots perfected their growth. The fruit is very late in ripening and of no particular merit as a foreign grape, and when treated as a native the result is as related.

Although mildew has been prevalent on many of the native varieties, all have escaped when grown on the covered trellis; a description of which was given in the report of 1861.

Further observation confirms the belief that the most valuable class of native grapes are those of the *frost* family, of which the Clinton is a familiar example. In this class we have a perfectly hardy vine not subject to mildew, at least to any injurious extent; neither is rot in the fruit known in this class. Other recommendatory qualities are entire hardiness and great bearing capacity. No grapes promise so well for wine as this family, but improved seedlings must be produced, increasing the size of both bunch and berry. They are yet too acid as a table fruit, although they furnish a fair quality of wine.

PROPAGATING HOUSE.

The great art in propagating plants by cuttings depends upon the proper application of heat.

A cutting placed in a warm, humid atmospheric temperature, in soil wet and comparatively cold, will be excited into growth; the buds will burst, and probably leaves develop and grow until the juices of the slip are exhausted, when it will rapidly decay, without even an effort at root formation. On the contrary, let the soil in which the cutting is inserted be maintained at an average temperature of twenty degrees above that of the atmosphere, and other things being equal, roots will be formed with but little if any growth of the buds.

A structure for propagating cuttings should, therefore, afford facilities for securing these peculiarities of temperature in the soil and atmosphere.

Such a house has been erected in the garden. The building is eighty feet in length and twenty feet in width, divided by a partition about the centre. In one end is a propagating bed, thirty-five feet in length and eight feet in width. The other end is fitted up with staging for pots, as is usual in plant-houses.

The heating is effected by a flue, the furnace of which is placed opposite the middle of the house, the flue continuing its course under the staging, warming the atmosphere of that section. A shallow brick tank underlies the propagating bed, through which hot water circulates, thus keeping up the proper warmth in the bed; the water in the tank is heated in a small metal pipe inserted in the flue; the atmosphere will be heated by the radiation from the bed alone.

This arrangement is probably the best and most economical mode of heating such structures that has been devised, and when further proof of its efficiency has been obtained, drawings of the various details will be submitted.

TROPICAL FRUIT HOUSE.

Steps have been taken towards fitting up a building for the purpose of cultivating tropical fruits. In all tropical countries there are numerous highly es-

teemed fruits, many of which would undoubtedly succeed well under artificial treatment. The main feature in the treatment of these consists in warming the soil in which they grow. Hitherto the expense of imparting such warmth has prevented its more general application. But with the simple, cheap, and efficient modification adopted in the propagating house, it is believed that this difficulty need no longer exist.

WILLIAM SAUNDERS.

Hon. ISAAC NEWTON,
Commissioner of Agriculture.

METEOROLOGY OF 1864.

[From the Smithsonian Institute.]

The meteorological tables published in the various reports of the Department of Agriculture having been favorably received as both interesting and useful to a very large number of readers and correspondents, we have rendered them more complete by adding the averages of the year 1854, and calculating the mean temperature and amount of rain for the six years instead of five, as heretofore. As the results of the years since 1859 have not yet been ordered published by Congress, we could not include them without an amount of labor which cannot at present be afforded by the Department.

We have also corrected several errors which occurred in the tables of the monthly and bi-monthly reports, and made a few additions thereto, thus rendering them more accurate and full for preservation in this permanent form.

As the success of agricultural operations must necessarily depend on the weather, an accurate knowledge of its fluctuations and changes is much to be desired; and it is eminently proper that the information here furnished should be given in this report, a work probably more widely circulated, and now more frequently read and carefully studied by farmers, gardeners, and fruit-growers than any similar publication in our country. With these brief reasons for republishing these tables in this form, we will now give—

DIRECTIONS FOR USING THEM.

There are two tables for each month; one of the current weather of the month in 1864, at the places named; the other of averages and means of temperature and rain for the same month, in the several years, and in each State and Territory named.

The first table for each month shows the greatest heat and cold, or highest and lowest range of the thermometer, with the dates of occurrence, the mean temperature of the month, and the amount of rain (or snow computed as melted,) in inches and tenths, that fell in said month at the places named, as given by the respective observers. The observations were made daily, at 7 a. m. and at 2 and 9 p. m., and the rain or melted snow was carefully measured.

The second table for each month exhibits the average mean temperature and average depth of rain and melted snow, in each State and Territory named, for the years 1854, 1855, 1856, 1857, 1858, and 1859, also for these six years collectively, and for the years 1863 and 1864. The first column in this table gives the average number of places in each State and Territory in which observations were made.

Blanks signify that no observations were reported. Cyphers (0) denote the zero of Fahrenheit's thermometer, or that no rain or snow fell. A dash (—) signifies that the degrees immediately following in figures were below zero.

I. JANUARY, 1864—CURRENT WEATHER.

Place.	County.	Observer.	Date.	Maximum temp.	Date.	Minimum temp.	Mean temp.	Rain or melted snow.
MAINE.				°		°	°	In.
Steuben	Washington	J. D. Parker	14, 24	38	7	— 9	29.3	5.6
North Perry	....do	Wm. D. Dana	1	45	7	—12	20.0	2.43
Williamsburg	Piscataquis	Edwin Pitman	1, 25	40	7	—14	18.1	4.3
West Waterville	Kennebec	B. F. Wilbur	24	45	8	— 5	22.4	3.67
Lisbon	Androscoggin	Asa P. Moore	24	44	7, 8	— 7	21.7	3.11
Cornishville	York	G. W. Guptill	24	42	7	— 9	21.7	5.80
NEW HAMPSHIRE.								
Stratford	Coos	Branch Brown	24	39	7	—23	18.7	3.50
North Littleton	Grafton	Rufus Smith	24	36	7	—26	13.0	3.59
North Barnstead	Belknap	Charles H. Pitman	24, 25	44	7	— 2	26.3	1.10
Claremont	Sullivan	Arthur Chase	24	47	7	— 8	22.0	3.75
VERMONT.								
Lunenburg	Essex	H. A. Cutting	24	40	7	—20	18.8	4.83
Craftsbury	Orleans	Jas. A. Paddock	24	45	7	—18	19.2	4.83
Burlington	Chittenden	Rev. McK. Petty	24, 28	42	7	—20	21.4	3.08
Middlebury	Addison	H. A. Sheldon	1	40	7	—17	22.8	......
Brandon	Rutland	David Buckland	28	50	7	—11	24.2	2.02
MASSACHUSETTS.								
Sandwich	Barnstable	N. Barrows, M. D	26	51	7	7	29.7	4.89
Topsfield	Essex	John G. Caldwell	25, 26	49	7	5	28.7	2.54
New Bedford	Bristol	Samuel Rodman	26	51	7, 8	7	30.4	4.16
Mendon	Worcester	John G. Metcalf	24	48	7	0	25.4	3.40
Baldwinsville	....do	Rev. E. Dawhurst	29	45	2	— 5	21.6	2.87
Amherst	Hampshire	Prof. E. S. Snell	24, 29	44	7	— 2	24.4	2.70
Springfield	Hampden	J. Weatherhead	27, 28	52	11	— 4	24.7	2.51
Westfield	....do	Rev. E. Davis	24	49	11	— 7	23.3	2.69
Williams College	Berkshire	Prof. A. Hopkins	28	47	2	— 2	21.5	1.24
RHODE ISLAND.								
Providence	Providence	Prof. A. Caswell	27	50	8	4	27.3	4.66
CONNECTICUT.								
Pomfret	Windham	Rev. D. Hunt	28	48	2	0	26.0	3.34
New Haven	New Haven	D. C. Leavenworth	26, 29	52	11	— 2	27.0	......
NEW YORK.								
South Hartford	Washington	G. M. Ingalsbe	28	48	7	—10	24.8	1.56
Fishkill Landing	Dutchess	Wm. H. Denning	24, 27	50	7	3	36.3	1.97
Throg's Neck	Westchester	Francis Morris	25	53	2	6	29.3	2.27
Deaf and Dumb Ins.	New York	Prof. O. W. Morris	29	62	2	12	35.2	4.02
Gouverneur	St. Lawrence	C. H. Russell	28	49	7	—26	21.8	5.39
Theresa	Jefferson	S. O. Gregory	28	45	7	—26	22.3	2.78
Oswego	Oswego	Wm. S. Malcolm	28	49	2	— 6	26.3	4.45
Skaneateles	Onondaga	W. M. Beauchamp	28	58	2	— 5	25.3	......
Auburn	Cayuga	John B. Dill	28	54	2, 7	2	26.1	......
Seneca Falls	Seneca	Philo Cowing	27	62	2	— 2	27.7	......
Buffalo	Erie	Wm. Ives	28	56	2	— 9	25.5	3.17
Jamestown	Chautauqua	Rev. S. W. Roe	28	56	2	—14	24.2	2.72
NEW JERSEY.								
Newark	Essex	W. A. Whitehead	29	57	10	6	29.8	2.43
Burlington	Burlington	John C. Deacon	28, 29	65	2, 7	4	28.7	1.20
Progress	....do	Thomas J. Beans	29	62	12	4	29.0	2.46
Haddonfield	Camden	James S. Lippincott	28	66	7	7	32.0	......
PENNSYLVANIA.								
Philadelphia	Philadelphia	Pf. J. A. Kirkpatrick	29	63	2	7	33.2	2.56
Nazareth	Northampton	L. E. Ricksecker	28	65	2	0	29.8	......
Harrisburg	Dauphin	John Heisely, M. D	28, 29	53	2	8	29.4	3.12
Tioga	Tioga	E. T. Bentley	27, 28	62	3	— 8	62.7	......
Fleming	Centre	Samuel Brugger	27	62	2	— 4	27.4	1.49
Oil City	Venango	James A. Weeks	28, 29	60	2	— 7	26.2	......
Connellsville	Fayette	John Taylor	27, 28	54	7	—10	27.3	......
MARYLAND.								
Chestertown	Kent	Prof. J. R. Dutton	25	67	2	8	34.6	2.21
St. Inigoes	St. Mary's	Rev. J. Stephenson	24	88	7	15	38.4	1.00
Sykesville	Carroll	Miss H. M. Baer	28	64	2, 7	2	29.0	3.50
DIST. OF COLUMBIA.								
Washington	Washington	Smithsonian Inst'n	25	64	2	8	33.5	2.58
SOUTH CAROLINA.								
Beaufort	Beaufort	M. M. Marsh, M. D	30	74	2	18	46.0	1.25

I. JANUARY, 1864—CURRENT WEATHER—Continued.

Place.	County.	Observer.	Date.	Maximum temp.	Date.	Minimum temp.	Mean temp.	Rain or melted snow.
KENTUCKY.				°		°	°	*In.*
Louisville	Jefferson	Mrs. L. Young	27	71	8	—10	29.7	3.19
OHIO.								
Austinburg	Ashtabula	Dole & Griffing	28	58	2	—12	25.2	8.14
New Lisbon	Columbiana	J. F. Benner	28	62	2	—10	26.4	2.97
Welshfield	Geauga	B. F. Abell, A. M	28	58	2	—13	25.6	6.66
Kelley's Island	Erie	Geo. C. Huntington	28	54	1	—11	25.3	1.75
Westerville	Franklin	Pf. H. A. Thompson	28	61	6	—14	25.0	1.40
Kingston	Ross	Prof. J. Haywood	28	67	2	— 5	27.5	3.47
Portsmouth	Scioto	L. Engelbrecht	28	62	2	0	31.0	3.10
Urbana University	Champaign	Pf. M. G. Williams	28	64	6	—16	25.1	3.38
College Hill	Hamilton	J. H. Wilson	28	66	1	—14	25.8	3.25
Cincinnati	....do	G. W. Harper	28	65	1	—12	28.0	1.25
MICHIGAN.								
Monroe	Monroe	Flor. E. Whelpley	28	63	1	— 4	26.4	1.93
State Agric. College	Ingham	Prof. R. C. Kedzie	28	55	1	—22	23.3	1.29
INDIANA.								
Muncie	Delaware	E. J. Rice	28	64	1	—20	25.3	3.65
New Castle	Henry	Th's.B.Redding, A.M	28	64	1	—19	26.0	2.67
New Albany	Floyd	E. S. Crozier, M. D.	28	71	1	—10	29.7	3.22
South Bend	St. Joseph	Reuben Burroughs	28	65	1	—20	30.4	2.63
Rockville	Parke	Miss M. A. Anderson	28	66	1	—22	27.6	3.10
New Harmony	Posey	John Chappellsmith	29	67	1	—15	29.0	5.00
ILLINOIS.								
Sandwich	De Kalb	N. E. Ballou, M.D.	28	65	1, 7	—26	19.6	3.80
Ottawa	La Salle	Mrs. E. H. Merwin	28	62	1	—25	18.0	2.17
Winnebago	Winnebago	James W. Tolman	28	47	1	—28	15.1	2.45
Tiskilwa	Bureau	Verry Aldrich	28	60	1	—24	......	......
Peoria	Peoria	Frederick Brendel	28	66	8	—22	23.4	1.42
Pekin	....do	J. H. Riblett	28	65	1	—20	22.3	1.60
Hoyleston	Washington	J. Ellsworth	29	50	1	—20	......	......
Waverly	Morgan	Timothy Dudley	27	69	1	—24	22.2	2.70
Upper Alton	Madison	Mrs. J. Trible	28	72	1	—21	23.0	......
Galesburg	Knox	Prof. Wm. Livingston	28	62	1	—23	17.4	1.23
Augusta	Hancock	S. B. Mead, M. D.	27, 28	66	1	—26	20.0	1.98
WISCONSIN.								
Manitowoc	Manitowoc	Jacob Lüps	24	47	2	—26	20.5	1.77
Milwaukee	Milwaukee	I. A. Lapham, LL.D.	25	49	1	—30	18.8	2.15
Beloit	Rock	H. D. Porter	23	46	1	—29	15.8	5.10
MINNESOTA.								
St. Paul	Ramsey	Rev. A. B. Paterson	25	49	1	—35	11.3	0.38
Tamerack	Hennepin	Mary A. Grave	26	54	1	—35	8.2	......
Forest City	Meeker	Henry L. Smith	27	60	1	—38	14.6	......
IOWA.								
Lyons	Clinton	P.J.Farnsworth, M.D	27, 28	52	1	—24	18.7	1.10
Dubuque	Dubuque	Asa Horr, M. D	25	44	1	—29	15.2	2.62
Muscatine	Muscatine	I. P. Walton	28	55	7	—28	17.2	1.75
Fort Madison	Lee	Daniel McCready	28	60	1	—33	19.9	1.21
Mount Pleasant	Henry	E. L. Briggs	28	61	1	—24	19.2	0.75
Independence	Buchanan	A. C. Wheaton	25	48	2	—26	14.6	1.47
Pleasant Plain	Jefferson	T. McConnel	27	59	1	—26	19.0	0.90
Waterloo	Black Hawk	L. H. Doyle	26, 27, 28	44	7	—28	12.0	......
Iowa Falls	Hardin	N. Townsend	25, 27	45	1	—24	19.8	1.22
Algona	Kossuth	Dr. F. & Miss McCoy	28	44	1, 2	—24	16.2	0.46
MISSOURI.								
St. Louis	St. Louis	Aug. Fendler	27	71	1	—22	26.3	2.00
Laborville	....do	Wm. Muir	27	74	1	—18	29.5	1.70
Athens	Clark	J. T. Caldwell	28	63	6	—19	21.9	2.41
Canton	Lewis	George P. Ray	28	65	6	—33	19.6	1.32
Harrisonville	Cass	John Christian	27	68	1	—22	24.8	.....
KANSAS.								
Lawrence	Douglass	W. L. G. Soule	27	69	1	—17	24.4	1.81
State Agric. College	Riley	H. L. Denison	27	60	6	—13	23.9	0.44
Fort Riley	Davis	Elford E. Lee	27	69	1	—12	27.1	0.20
NEBRASKA TER.								
Elkhorn	Washington	Miss A. M. J. Bowen	26, 27	49	7	—22	16.1	......
Bellevue	Sarpy	Rev. Wm. Hamilton	27	53	1	—17	18.7	0.41

II. JANUARY—AVERAGES.

States and Territories.	Av. number of places.	Averages, 1854.		Averages, 1855.		Averages, 1856.		Averages, 1857.		Averages, 1858.		Averages, 1859.		Av. for six years.		Averages, 1863.		Averages, 1864.	
		Mean temp.	Mean rain.	Mean temp.	Mean rain.	Mean temp.	Mean rain.	Mean temp.	Mean rain.	Mean temp.	Mean rain.	Mean temp.	Mean rain.	Mean temp.	Mean rain.	Mean temp.	Mean rain.	Mean temp.	Mean rain.
		Deg.	*In.*	*Deg.*	*In.*	*Deg.*	*In.*	*Deg.*	*In.*	*Deg.*	*In.*	*Deg.*	*In.*	*Deg.*	*In.*	*Deg.*	*In.*	*Deg.*	*In.*
Maine	5	18.7	2.83	24.3	4.83	12.6	2.46	11.9	7.81	22.6	3.81	17.7	4.81	18.0	4.42	25.0	5.05	22.2	4.02
New Hampshire	4	19.5	2.82	25.8	5.65	15.8	2.95	10.4	3.34	25.1	2.46	16.1	3.82	18.8	3.50	26.4	3.24	20.1	3.27
Vermont	4	17.8	7.81	25.3	1.95	11.4	1.48	8.2	2.57	22.7	1.88	18.1	2.63	17.2	3.05	24.0	4.45	22.5	3.69
Massachusetts	12	25.0	2.73	29.1	4.88	18.0	3.24	16.0	5.06	31.2	3.20	26.0	7.04	24.3	4.36	30.5	5.34	25.5	3.03
Rhode Island	1	24.6	1.80	30.0	6.45	18.6	5.25	16.3	5.50	33.1	3.33	29.3	5.75	25.4	4.68	32.7	3.59	27.3	4.66
Connecticut	4	26.3	2.49	29.6	5.40	20.3	4.61	15.8	4.32	32.4	3.03	25.8	7.53	25.1	4.57	30.8	4.41	26.5	3.34
New York	19	24.3	3.79	27.7	3.36	16.9	2.82	13.9	3.04	31.0	2.25	26.4	3.52	23.4	3.13	30.6	3.95	26.4	3.26
New Jersey	5	29.5	1.60	32.4	3.37	20.6	3.67	19.6	4.43	37.2	3.58	31.7	5.47	28.5	3.85	35.1	4.27	29.9	2.03
Pennsylvania	19	28.6	2.69	30.0	2.72	18.6	2.54	18.4	2.69	36.3	2.15	30.5	3.52	27.1	2.72	32.5	4.37	28.6	2.59
Delaware	1	......	......	......	......	21.1	......	20.2	......	40.7	1.17	......	4.84	27.0	2.51	37.2	3.98	......	......
Maryland	5	31.8	3.79	33.8	3.28	21.9	3.59	21.9	2.88	38.6	1.67	34.2	4.69	30.4	3.32	37.2	3.98	34.0	2.24
District of Columbia	1	34.4	4.23	35.1	......	21.6	4.00	21.8	0.89	40.2	1.62	36.3	4.54	31.6	3.05	41.7	2.68	33.5	2.58
South Carolina	5	47.9	4.56	47.2	1.31	36.4	6.47	35.4	2.57	53.2	3.98	45.3	3.33	44.2	3.70	......	......	46.0	1.25
Tennessee	2	39.2	6.99	39.6	3.64	25.6	1.38	26.9	2.16	45.8	4.56	39.6	3.31	36.1	3.67	40.9	8.58	......	......
Kentucky	4	31.5	5.18	38.7	3.32	20.9	1.80	24.7	1.53	42.1	2.66	34.0	3.05	32.0	2.92	38.9	7.33	29.7	3.19
Ohio	19	29.8	2.77	31.4	2.73	17.4	1.69	16.8	1.39	37.3	1.72	30.5	2.42	27.2	2.12	33.4	5.60	26.5	3.52
Michigan	7	20.9	3.17	25.8	3.50	13.3	1.24	11.3	2.70	31.7	4.01	25.5	2.70	21.4	2.89	33.7	2.39	24.4	1.61
Indiana	4	27.5	2.09	33.6	4.66	21.5	0.80	16.9	1.01	38.5	2.64	31.8	2.29	28.3	2.25	33.8	4.57	27.7	3.33
Illinois	12	21.4	1.33	28.2	9.24	14.4	0.96	11.7	0.72	34.5	1.82	26.2	1.78	22.7	2.64	31.4	3.13	20.1	2.17
Wisconsin	9	12.2	4.36	21.2	2.60	9.7	8.56	6.9	1.12	29.7	2.07	19.7	1.21	16.5	3.32	25.1	2.72	18.4	2.67
Minnesota	3	2.4	0.80	0.8	......	0.9	2.35	6.0	0.91	20.9	2.51	11.1	0.98	7.0	1.51	19.3	1.18	11.4	0.38
Iowa	7	16.3	1.44	23.5	2.08	9.3	1.04	5.7	0.77	32.0	2.03	22.9	1.05	18.3	1.40	27.5	2.57	17.0	1.28
Missouri	2	26.7	0.75	33.8	4.66	20.1	1.03	19.3	0.41	39.6	2.85	33.4	2.32	28.8	2.00	42.9	3.88	24.4	1.86
Kansas	2	......	......	......	......	......	......	......	......	37.7	1.79	30.8	1.43	34.2	1.61	36.2	0.57	25.1	0.82
Nebraska Territory	1	10.4	......	......	......	......	......	......	......	32.9	1.82	22.4	0.94	21.8	1.38	29.8	0.75	17.4	0.41
California	2	44.7	3.45	44.4	2.67	65.2	4.57	50.1	1.49	46.7	2.50	45.6	1.41	49.5	2.68	44.2	3.54	......	......

I. FEBRUARY, 1864—CURRENT WEATHER.

Place.	County.	Observer.	Date.	Maximum temp.	Date.	Minimum temp.	Mean temp.	Rain or melted snow.
MAINE.				°		°	°	In.
West Waterville	Kennebec	B. F. Wilbur	7	46	19	—21	25.6	1.60
Steuben	Androscoggin	J. D. Parker	7, 23, 25	42	19	—16	24.7	1.70
Cornishville	York	G. W. Guptill	......	.....	......	.....	......	.....
NEW HAMPSHIRE.								
Stratford	Coos	Branch Brown	23	42	19	—25	20.2	1.17
North Littleton	Grafton	Rufus Smith	23	38	19	—27	15.3	1.63
Littleton	....do	Robt. C. Whiting	23	46	19	—28	22.5	1.35
North Barnstead	Belknap	Charles H. Pitman	5	46	17	—11	25.6	......
Claremont	Sullivan	Arthur Chase	24	48	19	—17	26.0	1.75
VERMONT.								
Lunenburg	Essex	H. A. Cutting	24	44	18, 19	—25	20.6	1.89
Craftsbury	Orleans	Jas. A. Paddock	23, 24	47	18	—18	20.9	1.60
Calais	Washington	Jas. K. Tobey	24	43	18	—20	20.1	......
Burlington	Chittenden	Rev. McK. Petty	24	46	18	—13	23.9	1.90
Middlebury	Addison	H. A. Sheldon	24	52	18	—12	27.7	0.90
Rutland	Rutland	S. O. Mead	23	60	18	— 8	30.6	......
Brandon	....do	David Buckland	5, 23, 24	46	18	—21	27.0	0.92
MASSACHUSETTS.								
Sandwich	Barnstable	N. Barrows, M. D	6	51	18	— 2	31.4	1.01
Topsfield	Essex	John H. Caldwell	23	48	18	— 6	30.5	0.95
New Bedford	Bristol	Samuel Rodman	23	51	18	0	32.5	1.42
Mendon	Worcester	John G. Metcalf	24	47	18	— 6	28.2	......
Baldwinsville	....do	Rev. E. Dewhurst	24	45	19	—16	25.8	0.67
Amherst	Hampshire	Prof. E. S. Snell	24	47	18	— 4	42.5	1.12
Springfield	Hampden	J. Weatherhead	5, 23	52	18	— 6	28.4	1.22
Westfield	....do	Rev. E. Davis	5	47	18	— 3	28.5	1.49
Williams College	Berkshire	Prof. A. Hopkins	23	45	18	—10	26.4	1.52
CONNECTICUT.								
Pomfret	Windham	Rev. D. Hunt	23	48	18	— 6	27.3	1.00
New Haven	New Haven	D. C. Leavenworth	5, 6, 24	48	18	— 2	31.0	......
NEW YORK.								
South Hartford	Washington	G. M. Ingalsbe	23	50	18	—15	29.1	1.75
Fishkill Landing	Dutchess	Wm. H. Denning	24, 25	49	17	5	31.0	0.95
Garrison's	Putnam	Thos. B. Arden	23	54	18	1	31.0	1.22
Throg's Neck	Westchester	Francis M. Rogers	24	54	18	5	32.4	1.11
Deaf and Dumb Inst.	New York	Prof. O. W. Morris	6	59	17, 18	8	36.8	2.04
Schenectady	Schenectady	Robt. M. Fuller	23	49	18	6	26.8	....
Gouverneur	St. Lawrence	Cyrus H. Russell	23	48	18	—27	23.7	1.61
Oneida	Madison	S. Spooner, M. D	25, 28	44	11, 17	—12	27.2	....
Oswego	Oswego	Wm. S. Malcolm	24	49	18	— 4	27.7	3.01
Skaneateles	Onondaga	W. M. Beauchamp	23	49	17	— 5	28.9	....
Auburn	Cayuga	John B. Dill	23	52	17	— 8	27.3	....
Seneca Falls	Seneca	Philo Cowing	23	54	17, 18	0	30.3	....
Rochester	Monroe	Prof. C. Dewey	23	54	18, 19	— 2	28.5	1.18
Wilson	Niagara	E. S. Holmes, D.D.S	23	57	17	— 3	27.8	0.81
Buffalo	Erie	Wm. Ives	22, 23	45	17	— 4	27.0	1.48
Fredonia	Chautauqua	Dan'l J. Pratt, A. M	23	54	17	— 4	27.8	2.19
Jamestown	....do	Rev. S. W. Roe	23	48	17	—14	24.7	2.70
NEW JERSEY.								
Paterson	Passaic	Wm. Brooks	23, 28	55	18	0	30.2	0.63
Newark	Essex	W. A. Whitehead	23	56	18	2	32.9	0.82
Progress	Burlington	Thos. J. Beans	23	58	18	3	32.2	0.56
Mount Holly	....do	M. J. Rhees, M. D	28	60	18	6	34.7	.....
Haddonfield	Camden	Jas. S. Lippincott	23	56	17, 18, 19	5	33.8	0.62
PENNSYLVANIA.								
Philadelphia	Philadelphia	Pf. J. A. Kirkpatrick	28	57	17, 18	5	35.3	0.70
Nazareth	Northampton	L. E. Ricksecker	23	58	18	0	32.5	......
Tioga	Tioga	E. T. Bentley	23	57	19	—12	29.0	......
Fleming	Centre	Samuel Brugger	23	60	19	— 7	29.6	0.84
Connellsville	Fayette	John Taylor	23	58	18	— 9	29.8	.....
Canonsburg	Washington	Rev. W. Smith, D.D	23	56	18, 19	—10	28.8	1.36

I. FEBRUARY, 1864—CURRENT WEATHER—Continued.

Place.	County.	Observer.	Date.	Maximum temp.	Date.	Minimum temp.	Mean temp.	Rain or melted snow.
MARYLAND.				°		°	°	In.
Chestertown	Kent	Prof. J. R. Dutton	28	62	18	5	36.2	0.37
St. Inigoes	St. Mary's	Rev. J. Stephenson	23	57	18	7	37.0	1.20
Sykesville	Carroll	Miss H. M. Baer	28	63	17, 18	0	31.5	0.55
DIST. OF COLUMBIA.								
Washington	Washington	Smithsonian Instit'n.	28	57	18	5	36.3	0.36
SOUTH CAROLINA.								
Beaufort	Beaufort	M. M. Marsh, M. D.	23. 24	80	20	23	52.0	......
KENTUCKY.								
Louisville	Jefferson	Mrs. L. Young	23	70	19	1	37.0	1.72
OHIO.								
East Fairfield	Columbiana	S. B. McMillan	23	55	18, 19	— 7	29.2	1.32
New Lisbon	....do	J. F. Benner	23	63	18	—12	29.6	1.34
Welshfield	Geauga	B. F. Abell, A. M.	23	56	18	— 9	28.2	3.05
Cleveland	Cuyahoga	Mr. and Mrs. Hyde.	23	61	18	— 3	31.9	0.53
Wooster	Wayne	Martin Winger	23	61	19	— 7	27.2	0.15
Kelley's Island	Erie	Geo. C. Huntington.	23	51	17	— 4	30.0	0.64
Westerville	Franklin	Pf. H. A. Thompson.	23	62	17, 19	— 6	31.0	......
Kingston	Ross	Pf. John Haywood	23	65	17, 18	— 2	32.9	1.52
Portsmouth	Scioto	L. Engelbrecht	23	63	18	5	36.2	3.10
Urbana University	Champaign	Pf. M. G. Williams	23	62	17	— 6	30.3	0.55
Hillsborough	Highland	J. McD. Mathews	23	63	18	— 4	32.7	1.74
Eaton	Preble	Miss Ollitippa Larsh.	23	59	17	— 7	31.0	0.53
College Hill	Hamilton	J. H. Wilson	27	62	17	— 6	31.1	1.45
Cincinnati	....do	Geo. W. Harper	22	60	17	— 5	34.6	0.99
MICHIGAN.								
Pontiac	Oakland	James A. Weeks	23	52	17	— 8	27.4	......
Monroe	Monroe	Miss F. E. Whelpley.	22	55	17	— 2	31.3	1.05
State Agric'l College	Ingham	Prof. R. C. Kedzie	23	50	17	—11	27.3	0.31
Clifton	Keweenaw	Wm. Van Orden, jr.	23	49	17	—20	20.4	1.80
INDIANA.								
Muncie	Delaware	E. J. Rice	27	62	17	— 9	30.9	2.20
New Castle	Henry	T. B. Redding, A. M.	27	60	17	— 7	31.0	1.13
Spiceland	....do	Wm. Dawson	27	59	17	— 7	30.9	2.20
New Albany	Floyd	E. S. Crozier, M. D.	23	72	17, 18, 19	— 3	36.4	1.47
South Bend	St. Joseph	Reuben Burroughs	23	51	18	—10	28.7	......
Indianapolis	Marion	Royal Mayhew	....	......	....	....	32.3	1.19
Bloomingdale	Park	Wm. H. Hobbs	23, 24	48	16, 17, 18	— 4	....	1.30
ILLINOIS.								
Ottawa	La Salle	Mrs. E. H. Merwin	24	56	16	—20	26.3	1.56
Winnebago	Winnebago	James W. Tolman	22	50	17	—16	24.5	......
Tiskilwa	Bureau	Verry Aldrich	24	58	17	—11	29.5	1.26
Peoria	Peoria	Frederick Brendel	22, 23	59	16, 17	— 5	33.0	0.41
Pekin	Tazewell	J. H. Riblett	22, 23	58	17	— 7	31.1	0.46
Waverly	Morgan	Timothy Dudley	22	64	17	— 6	32.5	0.70
Galesburg	Knox	Pf. Wm. Livingston	22	57	17	—10	28.2	0.56
Manchester	Scott	Dr. J. and Miss Grant	11, 22, 23	60	17	— 4	33.2	0.87
Augusta	Hancock	S. B. Mead, M. D.	22	63	17	— 8	31.4	0.58
WISCONSIN.								
Manitowoc	Manitowoc	Jacob Lüps	23	48	17	—16	26.0	1.52
Milwaukee	Milwaukee	I. A. Lapham, LL.D.	23, 24	48	17	—18	....	0.42
Green Bay	Brown	Friedrich Deckner	23	51	17	—20	23.2	0.82
Embarrass	Waupacca	J. Everett Breed	22	52	17	—20	22.9	2.45
Madison	Dane	Prof. J. W. Sterling.	21	50	17	—19	22.0	2.10
Beloit	Rock	H. D. Porter	22, 23	48	17	—16	24.5	1.20
Odanah	Ashland	Edwin Ellis	22, 23	46	18	—16	23.1	0.40
MINNESOTA.								
St. Paul	Ramsey	Rev. A. B. Paterson.	22	50	17	—20	21.6	0.00
New Ulm	Brown	Charles Roos	22	50	16	—16	23.5	......

I. FEBRUARY, 1864—CURRENT WEATHER—Continued.

Place.	County.	Observer	Date.	Maximum temp.	Date.	Minimum temp.	Mean temp.	Rain and melted snow.
IOWA.				°		°	°	*In.*
Lyons	Clinton	P. J. Farnsworth, M. D	22	58	16, 17	—10	24.6	0.25
Dubuque	Dubuque	Asa Horr, M. D	23	48	16	—14	21.4	0.74
Muscatine	Muscatine	Suel Foster	23	53	17	—11	26.7	0.25
Fort Madison	Lee	Daniel McCready	22	60	17	— 9	31.9	0.41
Iowa City	Johnson	Theo. S. Parvin, A. M	22, 23	56	17	—15	27.4	0.68
Mount Pleasant	Henry	E. L. and Miss Briggs	22	61	17	—10	29.3	0.41
Independence	Buchanan	A. C. Wheaton	22	50	17	—19	25.7	0.81
Iowa Falls	Hardin	N. Townsend	22	49	15	— 6	25.6	0.43
Algona	Kossuth	Dr. and Miss McCoy	22, 24	48	17	—17	24.3	......
Onowa	Monona	Rich. Stebbins, M. D	22	65	17	— 8	28.9	......
MISSOURI.								
Fox Creek	St. Louis	Wm. Muir	22, 24	68	16	0	38.5	1.30
Athens	Clark	J. T. Caldwell	24	75	18	— 3	40.0	0.25
Canton	Lewis	George P. Ray	22	65	17	— 6	31.7	0.46
Harrisonville	Cass	John Christian	15	60	17, 18	—10	....	......
KANSAS.								
Fort Riley	Davis	Elford E. Lee	24	77	16	9	39.6	......
NEBRASKA TER.								
Elkhorn	Washington	Miss A. M. J. Bowen	22	65	17	— 3	30.8	......
Bellevue	Sarpy	Rev. Wm. Hamilton	22	66	16, 17	— 2	31.6	......
WASHINGTON TER.								
Neeah Bay	Clallam	James G. Swan	22, 24	52	26	32	42.7	10.40
COLORADO TER.								
Montgomery	Park	James Luttrell	12	47	28	— 4	25.0	1.00

II. FEBRUARY—AVERAGES.

States and Territories.	Av. number of places.	Averages, 1854.		Averages, 1855.		Averages, 1856.		Averages, 1857.		Averages, 1858.		Averages, 1859.		Averages for six years.		Averages, 1863.		Averages, 1864.	
		Mean temp.	Mean rain.	Mean temp.	Mean rain.	Mean temp.	Mean rain.	Mean temp.	Mean rain.	Mean temp.	Mean rain.	Mean temp.	Mean rain.	Mean temp.	Mean rain.	Mean temp.	Mean rain.	Mean temp.	Mean rain.
		Deg.	*In.*	*Deg.*	*In.*	*Deg.*	*In.*	*Deg.*	*In.*	*Deg.*	*In.*	*Deg.*	*In.*	*Deg.*	*In.*	*Deg.*	*In.*	*Deg.*	*In.*
Maine	5	14.0	5.18	16.2	7.25	17.2	1.94	26.4	7.88	15.4	2.04	21.9	3.73	18.5	4.67	22.2	3.51	27.4	1.58
New Hampshire	4	19.7	4.16	18.8	5.64	17.5	1.53	28.8	2.52	16.6	1.60	23.7	2.26	20.9	2.95	25.3	3.32	21.9	1.72
Vermont	4	15.2	9.14	17.7	0.98	14.9	0.94	27.8	3.04	14.1	1.20	22.8	1.54	18.8	2.81	18.3	2.29	24.4	1.44
Massachusetts	12	24.1	6.19	21.2	3.38	20.8	1.09	32.6	2.51	22.4	1.68	28.3	4.17	24.9	3.17	26.9	5.34	30.5	1.18
Rhode Island	1	24.1	4.80	22.1	4.05	18.7	0.90	32.7	3.26	24.5	2.80	36.6	1.85	26.4	2.93	29.5	3.78	......	......
Connecticut	4	25.4	0.45	19.7	4.10	23.0	1.32	32.8	1.45	23.3	2.16	29.3	3.80	25.6	2.22	26.7	4.43	29.2	1.00
New York	18	23.6	3.71	18.0	1.83	15.6	8.82	32.7	2.45	21.5	2.00	29.8	2.41	25.2	3.54	25.3	3.46	28.9	1.63
New Jersey	4	31.4	5.43	25.1	3.26	23.7	0.84	37.1	1.77	26.4	2.51	33.4	3.48	29.5	2.88	32.6	4.25	32.8	0.51
Pennsylvania	19	30.4	4.95	23.0	2.59	22.2	1.14	36.4	1.54	25.6	1.90	33.6	3.13	28.6	2.54	31.3	4.05	30.8	0.97
Delaware	1	......	......	......	......	25.1	......	39.5	......	32.5	1.68	......	4.38	32.4	3.03	......	......	......	......
Maryland	5	35.3	4.48	26.2	2.07	26.1	0.84	40.4	0.68	27.7	1.64	36.9	3.49	32.1	2.20	35.2	4.33	34.9	0.71
District of Columbia	1	37.2	7.60	27.0	......	27.0	0.64	42.0	0.65	31.0	1.67	39.4	3.54	34.0	1.97	36.3	0.36	36.3	0.36
South Carolina	6	51.0	3.14	44.2	1.46	45.9	2.06	57.4	1.01	46.3	6.60	51.4	3.92	49.3	3.03	......	......	52.0	......
Tennessee	2	41.5	2.69	35.4	1.30	33.3	2.90	52.5	2.65	36.8	3.21	46.7	7.66	41.0	3.40	41.6	6.46	......	......
Kentucky	4	41.4	2.72	30.5	0.86	28.2	2.08	46.5	3.14	30.2	3.06	40.0	7.56	36.2	3.24	34.9	4.12	37.0	1.72
Ohio	19	35.2	3.26	23.7	1.70	23.2	1.92	39.8	2.50	24.5	2.30	34.0	4.21	30.0	2.65	31.7	3.23	31.0	1.31
Michigan	7	24.9	2.85	17.0	1.59	14.2	1.17	27.6	4.26	19.0	2.17	27.7	1.69	21.7	2.29	24.4	2.19	26.6	1.05
Indiana	4	35.0	2.98	27.6	0.75	24.2	0.77	41.9	4.60	25.8	2.00	37.0	5.16	31.9	2.71	32.9	2.24	31.6	1.44
Illinois	13	33.1	1.09	22.7	0.82	21.3	1.48	34.0	5.18	19.6	1.76	29.7	2.10	26.8	2.07	28.4	2.98	30.0	0.80
Wisconsin	9	24.7	5.87	13.1	1.23	15.4	0.40	25.8	2.77	16.0	0.89	23.3	1.44	19.7	2.10	21.6	1.81	23.6	1.27
Minnesota	3	14.1	0.05	7.7	......	12.1	......	10.7	3.30	10.1	0.70	14.6	0.58	11.5	1.01	15.5	1.18	22.5	......
Iowa	8	29.0	2.62	18.3	1.71	16.1	1.33	27.2	5.30	16.5	1.64	26.4	1.92	22.3	2.42	25.0	2.30	26.6	0.47
Missouri	2	38.4	5.65	29.9	0.63	26.0	3.64	42.1	6.29	29.2	1.81	36.9	5.35	33.7	3.89	41.9	3.47	36.7	0.67
Kansas	3	......	......	......	......	......	......	29.6	3.60	25.2	0.51	34.6	0.42	29.8	1.51	30.2	1.80	39.6	......
Nebraska Territory	3	26.7	......	......	......	......	......	......	......	17.3	0.80	23.8	0.68	22.6	0.74	24.9	0.73	31.2	......
California	2	50.9	8.68	52.7	2.67	52.2	0.44	50.4	4.87	53.9	2.01	51.0	4.58	51.8	3.87	45.4	4.26	......	......

I. MARCH, 1864—CURRENT WEATHER.

Place.	County.	Observer.	Date.	Maximum temp.	Date.	Minimum temp.	Mean temp.	Rain and melted snow.
MAINE.				°		°	°	*In.*
Steuben	Washington	J. D. Parker	12	47	23	7	29.7	5.16
Perry	...do	Wm. D. Dana	27	45	22	8	29.7	3.05
Williamsburg	Piscataquis	Edwin Pitman	27	48	21	0	28.5	3.00
West Waterville	Kennebec	B. F. Wilbur	5, 27	54	22	10	33.2	3.20
Lisbon	Androscoggin	Asa P. Moore	......	......	......	......	......	4.88
Cornishville	York	G. W. Guptill	27	51	21	10	30.4	7.35
NEW HAMPSHIRE.								
Stratford	Coos	Branch Brown	5	51	21	— 2	28.0	1.58
Sherburn	...do	F. Odell	27	55	22	— 3	31.7	1.15
Littleton	Grafton	Robert C. Whiting	29	52	21	0	35.1	1.50
North Littleton	...do	Rufus Smith	25	43	4	— 4	23.2	1.97
North Barnstead	Belknap	Chas. H. Pitman	5	54	22	14	32.1	......
Claremont	Sullivan	Arthur Chase	5	52	21	10	32.0	4.80
VERMONT.								
Lunenburg	Essex	Hiram A. Cutting	4, 5	53	21	0	31.2	3.93
Craftsbury	Orleans	Jas. A. Paddock	5	48	21	3	27.4	1.70
Calais	Washington	James K. Tobey	5	50	21	— 2	26.2	1.80
Burlington	Chittenden	Rev. McK. Petty	5	53	21	8	30.0	2.20
Middlebury	Addison	H. A. Sheldon	5	63	21	6	32.9	1.06
Rutland	Rutland	Stephen O. Mead	28	72	21	4	36.4	1.70
Brandon	...do	David Buckland	5	60	21	8	32.5	3.22
MASSACHUSETTS.								
Sandwich	Barnstable	N. Barrows, M. D.	12	54	21	19	35.9	6.75
Topsfield	Essex	Jno. H. Caldwell	5, 12, 13	52	22	16	36.3	4.30
New Bedford	Bristol	Sam'l Rodman	12	57	22	19	37.2	5.36
Mendon	Worcester	J. G. Metcalf	25	58	3, 21	17	34.7	2.95
Baldwinsville	...do	Rev. E. Dewhurst	25	52	22	9	31.2	......
Amherst	Hampshire	Prof. E. S. Snell	28	54	21, 22	15	34.4	2.58
Springfield	Hampden	J. Weatherhead	28	60	22	10	26.2	2.25
Westfield	...do	Rev. E. Davis	25	53	22	15	34.5	3.66
Williams College	Berkshire	Prof. A. Hopkins	5	54	22	4	30.6	2.24
CONNECTICUT.								
Pomfret	Windham	Rev. D. Hunt	25	53	22	15	33.8	2.12
Middletown	Middlesex	Prof. Jno. Johnston	28	59	22	15	35.4	2.06
New Haven	New Haven	D. C. Leavenworth	12, 28	55	22	17	39.3	......
NEW YORK.								
Moriches	Suffolk	Miss S. E. Smith	27	59	22	23	38.2	3.44
South Hartford	Washington	G. M. Ingalsbe	5	62	21	5	34.7	2.95
Fishkill Landing	Dutchess	Wm. H. Denning	5	53	21, 22	17	36.8	3.70
Garrison's	Putnam	Thos. B. Arden	25	54	21, 22	17	36.0	3.28
Throg's Neck	West Chester	Francis Morris	12	55	21	20	38.2	2.75
Flatbush	Kings	Eli T. Mack	12, 28	52	22	19	36.7	2.30
Deaf and Dumb Inst.	New York	Prof. O. W. Morris	5	58	21	22	40.7	2.15
Schenectady	Schenectady	Robert M. Fuller	27	53	21	11	31.8	......
Gouverneur	St. Lawrence	C. H. Russell	11	54	21	2	29.0	2.47
Clinton	Oneida	H. M. Paine, M. D.	4	57	3, 21	10	34.8	2.51
Theresa	Jefferson	S. O. Gregory	11, 29	50	21	0	28.8	1.79
Skaneateles	Onondaga	W. M. Beauchamp	4	54	21	3	29.9	......
Auburn	Cayuga	John B. Dill	4	60	21	6	32.0	......
Seneca Falls	Seneca	Philo Cowing	4	58	21	8	33.6	......
Rochester	Monroe	Prof. C. Dewey	4	57	21	7	31.9	3.44
Wilson	Niagara	E. S. Holmes, D.D.S.	4	54	20, 21	10	31.0	2.50
Buffalo	Erie	Wm. Ives	28	60	21	9	32.0	2.40
Jamestown	Chautauqua	Rev. S. W. Roe	4	60	21, 22	2	28.9	1.20
NEW JERSEY.								
Paterson	Passaic	Wm. Brooks	13	54	21	16	35.8	3.68
Newark	Essex	W. A. Whitehead	13	56	22	18	37.4	3.15
Burlington	Burlington	John C. Deacon	13	60	22	17	36.0	3.80
Progress	...do	Thos. J. Beans	13	58	21, 22	20	37.1	4.61
Haddonfield	Camden	Jas. S. Lippincott	13	61	22, 23	22	39.3	6.03
Greenwich	Cumberland	C. Sheppard	28	60	22	22	39.4	2.00

I. MARCH, 1864—CURRENT WEATHER—Continued.

Place.	County.	Observer.	Date.	Maximum temp.	Date.	Minimum temp.	Mean temp.	Rain and melted snow.
PENNSYLVANIA.				°		°	°	*In.*
Philadelphia	Philadelphia	Pf. J. A. Kirkpatrick	13	59	21, 23	22	39.5	5.24
Nazareth	Northampton	L. E. Ricksecker	28	62	21	16	37.7	......
Silver Spring	Lancaster	H. G. Bruckhart	12	56	21	18	36.0	......
Harrisburg	Dauphin	John Heisely, M. D.	28	54	21, 22	22	38.1	4.55
Tioga	Tioga	E. T. Bentley	27	60	21	2	33.6	6.30
Fleming	Centre	Samuel Brugger	4	59	21	10	33.6	4.61
Canonsburg	Washington	Rev. Wm. Smith, D.D.	11	56	21	6	32.9	3.04
DELAWARE.								
Wilmington	New Castle	U. D. Hedges, M. D.	5	59	21, 23	19	38.5	6.45
MARYLAND.								
Chestertown	Kent	Prof. J. R. Dutton	12	56	23	23	39.2	2.51
St. Inigoes	St. Mary's	Rev. J. Stephenson	13	60	23	25	40.7	3.81
Sykesville	Carroll	Miss H. M. Baer	13, 28	56	3	16	34.0	4.25
DIST. OF COLUMBIA.								
Washington	Washington	Smithsonian Instit'n.	12, 13	55	21	22	40.3	4.43
SOUTH CAROLINA.								
Beaufort	Beaufort	M. M. Marsh, M. D	13	80	17	34	55.0	2.59
Hilton Head	....do	Maj. J. W. Abert	11	78	24	41	61.2	......
KENTUCKY.								
Louisville	Jefferson	Mrs. L. Young	27	70	2	14	43.6	2.35
OHIO.								
Austinburg	Ashtabula	Dole & Griffing	11, 28	58	23	6	31.2	3.80
New Lisbon	Columbiana	J. F. Benner	11	63	21	6	33.7	2.96
East Fairfield	....do	S. B. McMillan	11, 28	56	21	6	33.1	2.70
Welshfield	Geauga	B. F. Abell, A. M.	27, 28	58	19, 20	11	32.5	3.49
Cleveland	Cuyahoga	G. A. Hyde	28	62	21	15	35.9	1.90
Wooster	Wayne	Martin Winger	27	61	21	10	....	....
Kelley's Island	Erie	Geo. C. Huntington	27	60	21	10	34.0	2.11
Westerville	Franklin	Pf. H. A. Thompson	28	63	21	15	35.0	1.00
Kingston	Ross	Pf. John Haywood	28	66	21	13	37.7	3.25
Portsmouth	Scioto	L. Engelbrecht	28	67	2	13	40.1	2.85
Toledo	Lucas	J. B. Trembly, M. D.	27	67	21	9	35.7	1.94
Urbana University	Champaign	Pf. M. G. Williams	28	69	21	9	35.7	2.33
Hillsborough	Highland	J. McD. Mathews	28	66	21	10	40.0	2.00
Eaton	Preble	Miss Ollitippa Larsh	27	64	21	6	36.0	2.18
College Hill	Hamilton	I. H. Wilson	28	62	21	10	38.6	0.90
Do	....do	John W. Hammitt	28	66	21	10	38.3	1.83
MICHIGAN.								
Pontiac	Oakland	James A. Weeks	26, 27	57	20	7	32.8	......
Monroe	Monroe	Miss F. E. Whelpley	4, 27	56	20	9	34.9	2.42
State Agric'l College	Ingham	Prof. R. C. Kedzie	28	59	23	2	31.8	1.96
INDIANA.								
Muncie	Delaware	E. J. Rice	27	68	21	— 5	35.4	2.40
Spiceland	Henry	Wm. Dawson	28	65	21	11	36.3	3.20
New Castle	....do	T. B. Redding, A. M.	28	68	21	6	36.6	2.85
New Albany	Floyd	E. S. Crozier, M. D.	10	73	21	18	40.3	1.59
South Bend	St. Joseph	Reuben Burroughs	27	62	20	10	34.1	4.50
Indianapolis	Marion	Royal Mayhew	27	69	21	10	37.8	2.77
New Harmony	Posey	John Chappellsmith	9, 10	70	16	17	40.6	0.97
ILLINOIS.								
Sandwich	De Kalb	N. E. Ballou, M. D	26	65	21	3	32.3	5.31
Ottawa	La Salle	Mrs. E. H. Merwin	26	62	20	10	34.1	2.85
Winnebago	Winnebago	Jas. W. Tolman	3	57	20	3	31.4	2.71
Tiskilwa	Bureau	Verry Aldrich	26	60	21	5	33.4	......
Elmira	Stark	O. A. Blanchard	28	50	20	13	35.0	2.25
Peoria	Peoria	Frederick Brendel	27	68	20	14	38.8	2.20
Pekin	Tazewell	J. H. Riblett	27	67	21	8	36.6	2.49
Waverly	Morgan	Timothy Dudley	10	69	5	12	36.9	0.80
Galesburg	Knox	Pf. W. Livingston	26	64	20	5	31.2	3.14
Manchester	Scott	John Grant, M. D.	27	72	21	12	37.5	2.00
Augusta	Hancock	S. B. Mead, M. D.	27	65	20	11	35.1	2.26

I. MARCH, 1864—CURRENT WEATHER—Continued.

Place.	County.	Observer.	Date.	Maximum temp.	Date.	Minimum temp.	Mean temp.	Rain and melted snow.
WISCONSIN.				°		°	°	In.
Manitowoc	Manitowoc	Jacob Lüps	25	45	20	0	30.5	1.73
Milwaukee	Milwaukee	I. A. Lapham, LL.D.	3	52	20	— 1	30.7	2.52
Green Bay	Brown	Friedrich Deckner	25	54	20	— 5	27.4	1.04
Bloomfield	Walworth	Wm. H. Whiting	26	54	20	2	30.7	......
Embarrass	Waupacca	J. Everett Breed	25	56	20, 21	— 9	36.6	1.21
Madison	Dane	Prof. J. W. Sterling	25	52	20	— 1	30.2	......
Beloit	Rock	Henry D. Porter	3, 24, 26	56	20	1	31.4	1.35
MINNESOTA.								
Beaver Bay	Lake	C. Wieland	25	44	20	—14	23.3	2.13
St. Paul	Ramsey	Rev. A. B. Paterson	3	56	20	— 8	26.8	0.13
Tamarack	Hennepin	Miss Mary A. Grave	3	56	20	— 8	....	......
New Ulm	Brown	Charles Roos	3	57	20	— 5	27.3	2.70
IOWA.								
Lyons	Clinton	P. J. Farnsworth, M.D	25, 26	58	20, 21	8	34.2	3.50
Dubuque	Dubuque	Asa Horr, M. D	3	58	19, 20	4	32.2	1.34
Muscatine	Muscatine	I. P. Walton	26	59	21	3	33.2	2.56
Fort Madison	Lee	Daniel McCready	26	62	21	8	34.8	1.36
Iowa City	Johnson	Theo. S. Parvin, A.M	24, 26	60	19	5	32.6	5.64
Mount Pleasant	Henry	Rev. E. L. and Miss Briggs.	3, 27	60	20	5	33.7	2.14
Independence	Buchanan	A. C. Wheaton	3	60	20	4	32.6	2.20
Pleasant Plain	Jefferson	T. McConnel	26	66	20	— 4	34.3	2.80
Iowa Falls	Hardin	Nathan Townsend	3	59	20	— 1	29.1	1.59
Algona	Kossuth	Dr. F. McCoy	3	63	19, 20	2	30.4	1.50
Onawa	Monona	Rich'd Stebbins, M.D	27	66	22	— 6	31.7	......
MISSOURI.								
Laborville	St. Louis	William Muir	27	74	21	20	41.1	2.30
Athens	Clark	J. T. Caldwell	25	70	20	12	46.3	......
Canton	Lewis	George P. Ray	27	71	21	8	34.6	1.83
Harrisonville	Cass	John Christian	26, 27	72	21	18	41.3	0.88
KANSAS.								
State Agric'l College	Riley	H. L. Denison	26	68	23	20	38.3	2.12
Fort Riley	Davis	Elford E. Lee	8	63	15, 22	23	41.7	1.07
NEBRASKA TER.								
Elkhorn	Washington	Miss A. M. J. Bowen	3	67	20	6	33.0	......
Bellevue	Sarpy	Rev. Wm. Hamilton	3	65	20	7	35.0	......
WASHINGTON TER.								
Neeah Bay	Clallam	James G. Swan	17	58	11	32	43.8	14.80
IDAHO TER.								
Sweetwater Bridge	....	A. F. Ziegler, M. D	23	62	3, 13	4	30.8	3.21
COLORADO TER.								
Montgomery	Park	James Luttrell	17	46	28	0	26.2	3 70

II. MARCH—AVERAGES.

States and Territories.	Av. number of places.	Averages, 1854.		Averages, 1855.		Averages, 1856.		Averages, 1857.		Averages, 1858.		Averages, 1859.		Averages for six years.		Averages, 1863.		Averages, 1864.	
		Mean temp.	Mean rain.	Mean temp.	Mean rain.	Mean temp.	Mean rain.	Mean temp.	Mean rain.	Mean temp.	Mean rain.	Mean temp.	Mean rain.	Mean temp.	Mean rain.	Mean temp.	Mean rain.	Mean temp.	Mean rain.
		Deg.	*In.*	*Deg.*	*In.*	*Deg.*	*In.*	*Deg.*	*In.*	*Deg.*	*In.*	*Deg.*	*In.*	*Deg.*	*In.*	*Deg.*	*In.*	*Deg.*	*In.*
Maine	7	27.5	6.87	27.6	1.20	24.6	1.67	28.3	7.17	28.2	2.66	32.4	9.68	28.1	4.88	23.7	4.68	31.7	4.90
New Hampshire	4	26.9	2.63	30.9	6.36	25.3	1.19	30.7	2.06	29.5	1.22	32.5	6.51	29.3	3.33	23.0	3.50	30.1	2.76
Vermont	6	28.0	1.85	28.4	0.72	22.2	1.27	27.0	2.24	26.5	1.43	33.8	4.18	27.7	1.95	19.8	3.72	31.7	2.30
Massachusetts	9	31.8	2.99	32.1	1.69	26.4	1.46	31.3	2.61	32.1	1.81	38.4	5.99	32.1	2.76	27.7	5.78	33.4	3.76
Rhode Island	1	32.9	2.85	32.6	0.86	29.2	1.55	32.2	3.35	32.8	2.05	40.6	8.00	33.4	3.11	31.7	4.45	......	......
Connecticut	4	33.9	1.81	33.4	0.96	28.3	1.47	32.2	2.66	31.9	2.20	39.6	8.31	33.2	2.90	28.5	5.83	36.1	2.09
New York	12	32.9	3.42	30.5	1.53	25.7	1.82	31.0	2.57	32.3	1.18	39.3	5.00	32.0	2.59	27.7	3.45	33.4	2.71
New Jersey	6	39.1	1.26	36.8	1.83	30.6	1.74	35.9	3.12	37.4	1.40	45.8	6.40	37.6	2.63	34.1	5.25	37.5	3.88
Pennsylvania	7	38.0	2.24	34.6	2.04	29.2	1.73	35.2	1.63	37.1	0.95	44.5	5.59	36.4	2.37	34.5	5.67	35.9	4.75
Delaware	1	......	......	......	......	29.4	......	35.6	......	45.6	0.37	......	7.05	36.9	3.71	......	......	......	......
Maryland	3	43.0	1.94	39.0	3.62	33.5	1.78	38.4	1.62	39.2	0.85	48.8	5.42	40.3	2.54	37.6	3.64	37.9	3.52
District of Columbia	1	46.6	1.12	41.6	......	35.4	1.79	39.1	1.91	41.9	1.03	49.6	3.80	42.4	1.62	40.5	6.04	40.3	4.43
South Carolina	4	60.0	1.16	53.3	3.75	51.2	5.88	51.1	2.64	59.9	1.97	57.5	4.51	55.5	3.32	......	......	55.0	2.59
Tennessee	2	54.2	5.70	44.9	3.23	41.3	1.67	46.9	0.74	51.3	4.38	54.3	5.24	48.6	3.49	47.4	5.03	......	......
Kentucky	1	48.9	8.79	40.2	5.22	36.0	1.01	39.9	0.56	44.1	1.30	51.2	3.96	43.4	3.47	43.0	4.13	43.6	2.35
Ohio	15	43.4	4.76	35.4	2.80	29.8	1.92	34.5	1.21	37.4	1.36	45.9	4.30	37.7	2.73	34.4	2.97	36.0	2.38
Michigan	7	34.6	2.21	30.3	2.32	22.1	0.99	27.7	1.23	34.8	3.31	38.0	4.07	31.3	2.35	29.8	2.48	33.2	2.19
Indiana	6	42.1	5.11	37.0	4.40	34.3	0.58	37.1	1.25	42.2	2.04	47.2	4.06	40.0	2.91	38.7	3.79	36.7	2.56
Illinois	13	39.2	1.60	34.8	2.66	31.7	0.59	32.1	2.42	40.3	2.85	42.2	4.94	36.7	2.51	35.4	2.71	39.2	2.12
Wisconsin	10	34.5	1.33	27.5	1.83	24.8	0.32	27.5	1.04	34.7	1.81	35.2	4.26	30.7	1.76	30.2	2.04	31.1	1.55
Minnesota	2	25.0	2.48	25.6	......	21.1	......	22.9	1.00	33.7	1.16	30.2	3.03	26.4	1.92	28.9	0.63	27.0	1.42
Iowa	10	37.7	1.84	30.9	1.45	26.3	0.93	29.6	2.11	40.1	2.06	40.6	4.45	34.2	2.14	33.1	1.91	32.6	2.58
Missouri	4	45.9	5.48	39.4	2.45	37.4	1.06	39.5	1.80	48.2	3.53	48.4	7.32	43.0	3.61	43.2	3.17	40.8	1.67
Kansas	2	......	......	......	......	......	......	37.2	2.60	48.0	2.58	46.6	2.78	43.9	2.65	44.4	......	40.0	1.59
Nebraska Territory	2	36.3	......	......	......	......	......	......	......	44.7	1.80	39.8	1.73	40.2	1.76	36.1	0.50	34.0	......
California	2	50.2	3.39	56.3	4.26	57.5	1.10	56.3	0.74	54.4	3.25	51.6	2.35	54.4	2.52	53.4	2.85	......	......

I. APRIL, 1864—CURRENT WEATHER.

Place.	County.	Observer.	Date.	Maximum temp.	Date.	Minimum temp.	Mean temp.	Rain and melted snow.
MAINE.				°		°	°	In.
Steuben	Washington	J. D. Parker	30	55	4	20	28.5	2.41
North Perry	....do	Wm. D. Dana	25, 30	58	4	17	37.8	2.25
Williamsburg	Piscataquis	Edwin Pitman	22, 25	60	12	26	40.5	3.27
West Waterville	Kennebec	B. F. Wilbur	25	60	4, 6, 9, 12	28	41.2	......
Lisbon	Androscoggin	Asa P. Moore	30	60	5, 12	28	40.7	2.55
Cornishville	York	G. W. Guptill	22	60	4, 12	26	37.9	3.54
NEW HAMPSHIRE.								
Stratford	Coos	Branch Brown	25	61	6, 7, 18	28	39.5	1.30
Shelburn	....do	F. Odell	23	65	6	22	41.6	1.00
Littleton	Grafton	Robert C. Whiting	8	64	6	26	41.7	1.97
North Littleton	....do	Rufus Smith	22	56	4, 12	24	35.4	2.25
North Barnstead	Belknap	Chas. H. Pitman	30	65	4	28	40.5	......
VERMONT.								
Lunenburg	Essex	H. A. Cutting	26	68	6	24	41.2	1.90
Craftsbury	Orleans	James A. Paddock	22	59	18	27	38.9	2.43
Calais	Washington	James K. Tobey	23	62	7	20	35.5	......
Pomfret	Windham	Rev. D. Hunt	22, 23, 26	62	3, 5	29	41.1	2.05
Burlington	Chittenden	Rev. McK. Petty	22	61	17	30	40.0	2.55
Middlebury	Addison	H. A. Sheldon	22	67	6	23	42.8	2.96
Rutland	Rutland	S. O. Mead	8, 22, 26	62	5, 7	30	44.1	......
Brandon	....do	David Buckland	22	67	18	31	43.6	3.41
MASSACHUSETTS.								
Sandwich	Barnstable	N. Barrows, M. D.	26	69	4	32	42.9	2.68
Topsfield	Essex	John H. Caldwell	23, 24	62	3, 4	32	42.6	......
New Bedford	Bristol	Samuel Rodman	29	62	4	33	43.9	2.94
Mendon	Worcester	John G. Metcalf	29	62	4	28	41.4	......
Baldwinsville	....do	Rev. E. Dewhurst	24	63	3, 6	28	40.0	......
Amherst	Hampshire	Prof. E. S. Snell	22	65	4	31	42.1	2,57
Springfield	Hampden	J. Weatherhead	22	70	7	25	42.6	2.54
Westfield	....do	Rev. E. Davis	22	64	7, 13	30	43.0	2.32
Williams College	Berkshire	Prof. A. Hopkins	22	62	5, 6, 7	30	41.0	1.92
CONNECTICUT.								
Middletown	Middlesex	Prof. John Johnston.	22	70	13	31	45.6	1.82
New Haven	New Haven	D. C. Leavenworth	24	69	6, 7	32	46.0	......
NEW YORK.								
Moriches	Suffolk	Miss S. E. Smith	24, 29	67	3, 4	35	46.7	2.74
South Hartford	Washington	G. M. Ingalsbe	22	72	7	29	45.8	5.75
Fishkill Landing	Dutchess	Wm. H. Denning	23	72	5	31	47.7	3.29
Garrison's	Putnam	Thos. B. Arden	23	66	5	31	46.0	3.96
Throg's Neck	Westchester	Francis Morris	24	67	5	34	47.3	2.24
Flatbush	Kings	Eli T. Mack	27	65	5	33	46.1	2.35
Deaf and Dumb Inst.	New York	Prof. O. W. Morris	24	70	5	35	49.5	3.28
Schenectady	Schenectady	Robt. M. Fuller	22	66	6	32	44.1	3.38
Gouverneur	St. Lawrence	Cyrus H. Russell	22, 25	64	19	24	45.4	3.21
Clinton	Oneida	H. M. Paine, M. D.	22	71	28	32	46.3	2.38
Theresa	Jefferson	S. O. Gregory	22	63	27	29	41.4	4.75
Oswego	Oswego	Wm. S. Malcolm	22	65	27	31	41.6	4.37
Skaneateles	Onondaga	W. M. Beauchamp	8, 22	60	28	27	41.1	......
Auburn	Cayuga	John B. Dill	8	70	28	28	44.4	......
Seneca Falls	Seneca	Philo Cowing	23, 24	64	4	30	45.4	......
Rochester	Monroe	Prof. C. Dewey	22	66	28	30	43.2	3.23
Wilson	Niagara	E. S. Holmes, D.D.S.	26	62	28	32	44.0	......
Buffalo	Erie	Wm. Ives	22	71	28	30	43.0	3.22
NEW JERSEY.								
Paterson	Passaic	Wm. Brooks	23	75	5	33	46.8	5.34
Newark	Essex	W. A. Whitehead	23	75	5	32	47.1	3.67
Burlington	Burlington	John C. Deacon	23, 24	75	4, 5	30	46.7	4.00
Progress	....do	Thos. J. Beans	23	75	5	34	48.3	3.33
Haddonfield	Camden	Jas. S. Lippincott	24	77	8	36	49.6	2.99
Greenwich	Cumberland	Clarkson Sheppard	24	77	4	36	50.7	3.19
PENNSYLVANIA.								
Philadelphia	Philadelphia	Pf. J. A. Kirkpatrick.	23, 24	75	5	33	49.6	4.48
Nazareth	Northampton	L. E. Ricksecker	23, 24	75	5	32	47.7	......
Tioga	Tioga	E. T. Bentley	27	73	17, 19, 21, 22	32	46.5	4.70

I. APRIL, 1864—CURRENT WEATHER—Continued.

Place.	County.	Observer.	Date.	Maximum temp.	Date.	Minimum temp.	Mean temp.	Rain and melted snow.
PENN'VANIA—Con'd.				°		°	°	In.
Fleming	Centre	Samuel Brugger	24	81	12	33	46.6	3.56
Connellsville	Fayette	John Taylor	23	72	29	25	43.6	......
Canonsburg	Washington	Rev. W. Smith, D.D.	23	75	21	32	45.1	2.64
DELAWARE.								
Wilmington	Newcastle	U. D. Hedges, M. D.	24	76	4	33	49.4	7.50
MARYLAND.								
Chestertown	Kent	Prof. J. R. Dutton	23	73	4, 5	36	51.2	4.82
St. Inigoes	St. Mary's	Rev. J. Stephenson	8	62	2	34	47.8	6.36
Sykesville	Carroll	Miss H. M. Baer	23	76	2, 4, 5	32	48.9	7.25
DIST. OF COLUMBIA.								
Washington	Washington	Smithsonian Inst'n	27	72	2, 4	36	43.0	6.82
SOUTH CAROLINA.								
Beaufort	Beaufort	M. M. Marsh, M.D	28	90	16	46	61.0	1.49
Hilton Head	....do	Maj. Jas. W. Abert	28	94	17	52	66.1	1.89
TENNESSEE.								
Chattanooga	Harrison	George H. Bloker	27	86	3	38	58.3	......
KENTUCKY.								
Louisville	Jefferson	Mrs. L. Young	23	78	3, 20	31	51.0	3.07
OHIO.								
New Lisbon	Columbiana	J. F. Benner	23	78	21	25	46.9	2.21
East Fairfield	....do	S. B. McMillan	23, 24	73	1	34	46.9	2.42
Welshfield	Geauga	B. F. Abell, A.M	24	70	28	32	45.2	4.68
Cleveland	Cuyahoga	Mr. and Mrs. Hyde	22	55	2, 21, 28	39	46.6	1.96
Wooster	Wayne	Martin Winger	24	76	21	34	47.3	......
Kelley's Island	Erie	Geo. C. Huntington	26	58	1	36	45.0	4.47
Westerville	Franklin	Pf. H. A. Thompson	23	71	16	36	50.0	1.91
Kingston	Ross	Prof. J. Haywood	23	77	19	31	49.4	2.14
Portsmouth	Scioto	L. Engelbrecht	23	76	21	38	51.1	2.83
Urbana University	Champaign	Prof. M. G. Williams	23	75	17	33	46.8	2.51
Hillsborough	Highland	J. McD. Mathews	23	75	28	33	47.1	3.52
Eaton	Preble	Miss Ollitippa Larsh	23	71	17, 28	38	47.0	3.82
College Hill	Hamilton	I. H. Wilson	23	72	19	36	49.8	5.10
Do	....do	John W. Hammitt	23	83	13, 28	38	49.6	5.38
MICHIGAN.								
Pontiac	Oakland	Jas. A. Weeks	11, 21	60	20, 27, 28	34	44.3	......
Monroe	Monroe	Miss F. E. Whelpley	26	65	20	34	45.7	2.90
State Agric. College	Ingham	Prof. R. C. Kedzie	21, 26	61	18	34	44.3	3.80
INDIANA.								
Muncie	Delaware	E. J. Rice	23	65	1	32	49.2	4.10
Spiceland	Henry	Wm. Dawson	23	70	16	33	47.7	4.50
Newcastle	....do	T. B. Redding, A.M.	26	74	19	32	49.5	5.18
New Albany	Floyd	E. S. Crozier, M.D	23	78	21	34	51.5	1.79
South Bend	St. Joseph	Reuben Burroughs	26	67	16, 20	32	45.5	5.47
Indianapolis	Marion	Royal Mayhew	7, 23	70	3	36	49.3	4.38
ILLINOIS.								
Evanston	Cook	Wm. H. Morrison	22	59	16	37	44.4	2.05
Sandwich	De Kalb	N. E. Ballou, M. D	26	71	2	32	44.6	3.14
Ottawa	La Salle	Mrs. E. H. Merwin	26	80	19	30	44.9	3.64
Winnebago	Winnebago	James W. Tolman	26	74	16	33	43.6	2.66
Tiskilwa	Bureau	Verry Aldrich	7, 26	70	19	32	45.6	......
Peoria	Peoria	Frederick Brendel	26	74	13, 14	38	49.5	4.81
Pekin	Tazewell	J. H. Riblett	26	74	6, 11, 20	33	49.1	4.85
Hoyleston	Washington	J. Ellsworth	7	76	13, 15, 16	36	50.1	7.44
Waverly	Morgan	Timothy Dudley	7	78	16	35	49.2	4.60
Upper Alton	Madison	Mrs. A. C. Triblo	7	76	2	36	50.7	......
Galesburg	Knox	Prof. W. Livingston	26	73	2, 5	36	40.1	4.02
Manchester	Scott	Dr. J. & Miss Grant	22, 29	73	16	32	49.0	4.35
Augusta	Hancock	S. B. Mead, M.D	26	73	2, 13	34	47.0	6.76

I. APRIL, 1864—CURRENT WEATHER—Continued.

Place.	County.	Observer.	Date.	Maximum temp.	Date.	Minimum temp.	Mean temp.	Rain and melted snow.
				°		°	°	*In.*
WISCONSIN.								
Manitowoc	Manitowoc	Jacob Lüps	26	59	16	31	40.8	2.83
Milwaukee	Milwaukee	I. A. Lapham, LL.D.	26, 27	61	17	30	....	3.01
Green Bay	Brown	Friedrich Deckner	21, 26	65	11, 15, 16	30	36.7	2.48
Embarrass	Waupacca	J. Everett Breed	24	68	17	20	40.5	1.70
Madison	Dane	Prof. J. W. Sterling.	26	74	9	30	42.0	1.40
Beloit	Rock	Henry D. W. Porter.	26	76	16	33	43.5	2.66
MINNESOTA.								
Beaver Bay	Lake	C. Wieland	22	55	6	27	37.7	0.25
St. Paul	Ramsey	Rev. A. B. Paterson.	25	71	15	30	42.6	0.56
New Ulm	Brown	Charles Roos	25	78	2	31	45.3	0.22
IOWA.								
Lyons	Clinton	P. J. Farnsworth, M. D	26	74	16	36	47.1	4.50
Dubuque	Dubuque	Asa Horr, M. D	26	72	6	35	46.2	1.16
Muscatine	Muscatine	Isaiah P. Walton	26	76	15	30	44.7	3.43
Fort Madison	Lee	Daniel McCready	26	76	5, 13, 14	32	47.4	5.93
Iowa City	Johnson	Prof. T. S. Parvin	26	71	13	32	46.1	3.97
Mount Pleasant	Henry	Rev. E. L. Briggs	26	76	5, 13, 14	34	45.5	4.24
Independence	Buchanan	A. C. Wheaton	26	69	2, 5	34	46.2	2.30
Waterloo	Black Hawk	T. Steed	25	70	2, 5	30	48.0	......
Iowa Falls	Hardin	N. Townsend	25	66	2, 5, 10	30	41.9	4.30
Algona	Kossuth	Dr. F. & Miss McCoy	25	80	9	32	43.9	2.38
Onawa	Monona	Rich'd Stebbins, M. D	25	80	15	28	45.0	......
MISSOURI.								
Fox Creek	St. Louis	Wm. Muir	26	79	16	36	52.9	16.1
Athens	Clark	J. T. Caldwell	1	65	5, 6, 11, 13, 20, 30	30	48.9	4.24
Canton	Lewis	George P. Ray	26	83	13, 16	34	48.0	7.43
Harrisonville	Cass	John Christian	26	80	1, 15	36	52.7	6.06
KANSAS.								
Olathe	Johnson	W. Beckwith	20	84	2, 15	26	....	6.00
State Agric. College.	Riley	H. L. Denison	20, 21	79	5	27	48.3	1.68
Fort Riley	Davis	Elford E. Lee	20	84	1, 4	33	54.3	0.89
NEBRASKA TER.								
Elkhorn	Washington	Miss A. M. J. Bowen.	25	79	5	28	46.3	......
Bellevue	Sarpy	Rev. Wm. Hamilton.	25	78	2	28	45.2	2.40
UTAH TER.								
Gt. Salt Lake City	Great Salt Lake	W. W. Phelps	18	80	3	30	52.8	1.37
COLORADO TER.								
Montgomery	Park	James Luttrell	18	60	8	8	31.0	5.56
IDAHO TER.								
Fort Laramie	....	....	19	87	1	20	43.4	......
Fort Halleck	....	I. H. Finfrock	18	68	6	21	37.6	1.30

II. APRIL—AVERAGES.

States and Territories.	Av. number of places.	Averages, 1854.		Averages, 1855.		Averages, 1856.		Averages, 1857.		Averages, 1858.		Averages, 1859.		Averages for six years.		Averages, 1863.		Averages, 1864.	
		Mean temp.	Mean rain.	Mean temp.	Mean rain.	Mean temp.	Mean rain.	Mean temp.	Mean rain.	Mean temp.	Mean rain.	Mean temp.	Mean rain.	Mean temp.	Mean rain.	Mean temp.	Mean rain.	Mean temp.	Mean rain.
		Deg.	In.	Deg.	In.	Deg.	In.	Deg.	In.	Deg.	In.	Deg.	In.	Deg.	In.	Deg.	In.	Deg.	In.
Maine	6	36.7	3.50	38.4	6.38	42.6	2.78	39.0	6.65	39.7	4.15	38.6	3.36	39.2	4.47	40.8	4.83	37.8	2.80
New Hampshire	4	40.8	4.86	42.2	4.73	44.3	2.20	39.9	6.22	41.0	2.94	36.1	2.73	40.7	3.94	42.3	3.16	40.1	2.12
Vermont	4	38.6	5.72	40.5	1.61	44.2	1.20	38.7	4.96	40.9	2.23	38.2	2.30	40.2	3.00	40.2	1.96	40.9	2.55
Massachusetts	12	42.5	6.45	43.6	4.95	45.4	3.23	41.8	7.25	45.1	3.29	42.9	3.46	43.5	4.78	44.8	4.22	42.2	2.30
Rhode Island	1	42.0	6.96	44.1	2.50	48.8	2.80	41.0	6.29	46.2	3.63	44.2	2.28	44.4	4.08	45.2	5.50	...	...
Connecticut	4	42.9	7.07	44.2	3.31	47.2	3.99	41.1	6.65	44.9	3.75	44.1	3.18	44.1	4.65	45.3	3.31	45.8	1.82
New York	18	43.4	7.27	44.4	2.78	47.2	2.39	39.1	5.88	45.8	3.26	43.3	4.97	43.9	4.43	43.8	3.28	45.9	3.52
New Jersey	4	49.2	8.40	49.1	1.85	50.4	2.60	42.8	6.94	48.9	3.95	46.9	5.00	47.9	4.79	48.2	5.84	48.4	3.75
Pennsylvania	19	47.6	6.17	49.7	2.29	50.2	3.51	41.3	4.13	49.2	3.73	48.4	5.36	47.8	4.20	46.3	6.91	46.9	4.25
Delaware	1	...	...	...	...	52.1	...	50.1	...	58.4	...	...	3.93	53.5	3.93	...	...	...	...
Maryland	4	51.0	5.10	54.7	1.32	52.9	2.90	47.5	3.12	50.9	3.82	50.8	5.11	51.3	3.57	47.7	5.13	49.3	6.14
District of Columbia	1	52.8	5.38	55.7	...	54.7	2.68	45.3	2.40	53.4	3.66	52.2	4.69	52.4	3.76	49.6	6.82	43.0	6.82
South Carolina	5	61.0	2.69	64.9	0.89	64.6	0.63	56.5	2.92	64.2	2.59	62.9	2.48	62.3	2.03	...	...	63.5	1.69
Tennessee	2	58.3	2.39	64.9	3.25	59.4	4.18	49.7	5.72	60.1	4.86	57.9	5.79	58.4	4.37	57.7	3.27	58.3	...
Kentucky	4	54.9	2.07	60.6	1.63	58.8	1.63	42.2	4.46	56.5	4.72	54.2	5.93	52.0	3.41	54.8	3.38	51.0	3.07
Ohio	20	50.1	5.16	55.9	2.30	53.2	1.67	40.1	3.01	51.0	4.80	47.8	5.65	49.7	3.77	48.3	1.74	47.8	3.23
Michigan	7	46.2	2.77	49.2	4.78	45.0	1.87	35.4	2.96	44.7	3.99	40.9	3.47	43.5	3.30	44.7	1.91	44.5	3.35
Indiana	5	52.6	4.61	57.1	5.02	56.5	0.81	42.1	2.15	53.9	5.19	49.6	5.13	52.0	3.82	52.2	2.63	48.8	4.24
Illinois	13	53.3	1.62	58.6	2.16	54.8	1.93	38.7	1.56	49.8	5.17	44.9	3.55	50.1	2.66	51.8	1.87	46.8	4.39
Wisconsin	9	48.0	1.69	50.2	2.03	45.7	3.04	35.4	2.45	42.6	4.32	36.0	4.28	43.0	2.97	45.0	1.21	40.7	2.35
Minnesota	3	45.7	4.13	51.9	...	41.4	4.77	29.8	2.68	39.4	2.92	34.8	2.28	40.5	2.85	47.2	0.75	41.9	0.34
Iowa	8	52.0	1.24	55.6	2.27	51.7	3.33	36.8	1.35	46.5	5.48	37.7	3.34	46.8	2.84	50.2	1.07	45.7	3.58
Missouri	2	54.9	3.40	62.2	1.79	60.1	6.35	43.5	1.72	56.2	4.67	51.9	4.89	54.8	3.80	51.5	1.45	50.6	4.84
Kansas	3	...	...	...	...	...	...	41.6	0.33	52.5	3.49	50.3	2.67	48.1	2.17	59.3	3.74	51.3	2.86
Nebraska Territory	2	54.4	...	...	...	...	...	...	...	48.2	5.05	41.4	1.64	48.0	3.44	53.1	0.75	45.8	2.40
California	3	60.0	2.68	...	...	58.5	1.19	61.1	0.00	59.7	0.96	55.4	2.49	58.9	1.46	54.8	2.66	...	...

I. MAY, 1864—CURRENT WEATHER.

Place.	County.	Observer.	Date.	Maximum temp.	Date.	Minimum temp.	Mean temp.	Rain and melted snow.
MAINE.				°		°	°	*In.*
North Perry	Washington	Wm. D. Dana	17	74	3	38	50.7	2.59
Steuben	....do	J. D. Parker	28, 31	71	3	35	50.0	3.30
Williamsburg	Piscataquis	Edwin Pitman	6	75	3	38	53.2	5.07
West Waterville	Kennebec	B. F. Wilbur	31	75	3	42	55.8	3.05
Gardiner	....do	Rev. F. Gardiner	31	83	3	40	54.6	3.94
Lisbon	Androscoggin	Asa P. Moore	31	84	3	39	54.4	3.70
Cornishville	York	G. W. Guptill	31	82	3	36	54.9	2.65
NEW HAMPSHIRE.								
Stratford	Coos	Branch Brown	6, 16	77	3	36	54.3	4.75
North Littleton	Grafton	Rufus Smith	6, 10	74	4	32	51.3	4.86
Claremont	Sullivan	Arthur Chase	31	86	3	36	59.0	3.14
VERMONT.								
Lunenburg	Essex	Hiram A. Cutting	16	88	6	31	55.5	6.85
Craftsbury	Orleans	James A. Paddock	6	75	11	34	56.1	3.13
Calais	Washington	James K. Tobey	9	80	11	33	53.6	......
Burlington	Chittenden	Rev. McK. Petty	6	78	11	34	56.1	3.13
Middlebury	Addison	H. A. Sheldon	31	86	2, 11	38	59.3	2.72
Brandon	Rutland	David Buckland	21	84	11	37	59.8	2.96
MASSACHUSETTS.								
Newbury	Essex	John H. Caldwell	31	86	3	41	56.2	0.58
New Bedford	Bristol	Samuel Rodman	31	80	3	43	58.5	2.81
Mendon	Worcester	John G. Metcalf	31	84	3	38	57.9	......
Amherst	Hampshire	Prof. E. S. Snell	31	86	3	40	60.4	2.54
Springfield	Hampden	J. Weatherhead	31	93	2	32	59.3	2.87
Westfield	....do	Rev. E. Davis	31	86	3	39	59.6	2.94
CONNECTICUT.								
Pomfret	Windham	Rev. D. Hunt	31	81	3	37	57.8	2.73
Middletown	Middlesex	Prof. John Johnston	31	91	3	43	62.6	3.82
NEW YORK.								
South Hartford	Washington	G. M. Ingalsbe	31	88	11	37	64.6	6.28
Fishkill Landing	Dutchess	Wm. H. Denning	31	85	3	45	64.6	3.14
Garrison's	Putnam	Thos. B. Arden	31	84	2	41	62.0	3.10
Throg's Neck	Westchester	Francis Morris	31	83	3	43	62.1	3.80
Flatbush	Kings	Eli T. Mack	9	87	2	40	61.5	3.00
Deaf and Dumb Inst.	New York	Prof. O. W. Morris	31	86	3	47	65.6	5.24
St. Xavier's College	....do	Rev. Jno. M. Aubier	31	85	3	43	63.2	3.79
Schenectady	Schenectady	Robert M. Fuller	31	85	23	41	62.3	......
Gouverneur	St. Lawrence	C. H. Russell	6	76	1	34	56.7	3.27
Clinton	Oneida	H. M. Paine, M. D.	6	86	1	40	63.8	3.73
Theresa	Jefferson	S. O. Gregory	16	82	10, 11	37	55.0	8.00
Oswego	Oswego	Wm. S. Malcolm	15, 25	76	3	34	55.8	6.73
Skaneateles	Onondaga	W. M. Beauchamp	6	82	3	35	57.8	......
Auburn	Cayuga	John B. Dill	6, 24, 31	86	3, 11	36	61.4	......
Palmyra	Wayne	Stephen Hyde	21	83	3	40	61.1	......
Seneca Falls	Seneca	Philo Cowing	21	90	3	37	63.8	......
Rochester	Monroe	M. M. Mathews, M.D.	21, 24	82	3	37	62.7	6.54
Wilson	Niagara	E. S. Holmes, D.D.S.	24, 31	81	2, 10, 11	41	58.0	......
Buffalo	Erie	Wm. Ives	15	86	10	35	57.0	6.32
NEW JERSEY.								
Paterson	Passaic	Wm. Brooks	21	90	2	40	63.9	8.55
Newark	Essex	Wm. Whitehead	31	82	1	39	62.0	5.28
Burlington	Burlington	John C. Deacon	10	86	2, 3, 4	44	65.6	6.40
Progress	....do	Thomas J. Beans	8	86	3	45	64.5	6.81
Haddonfield	Camden	James S. Lippincott	10	85	3	48	65.8	7.09
Greenwich	Cumberland	Clarkson Sheppard	8	87	3	46	66.6	4.43
PENNSYLVANIA.								
Fallsington	Bucks	Ebenezer Hance	8, 9, 10, 31	84	3	44	65.7	6.20
Philadelphia	Philadelphia	Pf. J. A. Kirkpatrick	31	86	3	47	67.0	9.04
Nazareth	Northampton	L. E. Ricksecker	8, 9, 10, 21, 31	86	3	42	65.0	......

I. MAY, 1864—CURRENT WEATHER—Continued.

Place.	County.	Observer.	Date.	Maximum temp.	Date.	Minimum temp.	Mean temp.	Rain and melted snow.
PENNSYLVANIA—Con.				°		°	°	*In.*
Silver Spring	Lancaster	H. G. Bruckhart	9	90	2	40	66.0	......
Harrisburg	Dauphin	John Heisely, M. D	8, 31	86	3	44	66.7	5.36
Tioga	Tioga	E. T. Bentley	21	90	2	36	63.4	10.02
Williamsport	Lycoming	H. C. Moyer	24	81	11	41	62.5	......
Fleming	Centre	Samuel Brugger	24	93	1, 2, 3	40	63.1	6.74
Canonsburg	Washington	Rev. Wm. Smith, D D	24	82	3	35	60.2	2.34
DELAWARE.								
Wilmington	Newcastle	U. D. Hedges, M.D	8, 9	88	3	43	66.5	9.80
MARYLAND.								
Chestertown	Kent	Prof. J. R. Dutton	8, 31	86	2	44	68.0	3.39
St. Inigoes	St. Mary's	Rev. J. Stephenson	31	90	....	......	70.8	2.83
Sykesville	Carroll	Miss H. M. Baer	24	86	2, 3	45	65.9	8.50
Union Bridge	....do	W. Gillingham	24	88	2	45	66.9	10.06
DIST. OF COLUMBIA.								
Washington	Washington	Smithsonian Instit'n	8, 10, 31	84	2	45	68.0	4.62
SOUTH CAROLINA.								
Beaufort	Beaufort	M. M. Marsh, M. D	23	94	3	52	70.0	3.56
Hilton Head	....do	Lt. Chas. R. Suter	27	94	3	58	74.1	4.70
KENTUCKY.								
Louisville	Jefferson	Mrs. L. Young	23	89	3, 4	33	63.5	4.18
OHIO.								
New Lisbon	Columbiana	J. F. Benner	6	88	2, 3	40	62.9	3.14
East Fairfield	....do	S. B. McMillan	21, 23	83	3	38	61.0	2.67
Steubenville	Jefferson	Roswell Marsh	....	87	....	38	....	3.40
Welshfield	Geauga	B. F. Abell, A. M	20	87	3	33	60.2	4.42
Cleveland	Cuyahoga	G. A. Hyde	23, 31	86	3	39	60.3	3.57
Wooster	Wayne	Martin Winger	31	87	11	33	62.1	......
Kelley's Island	Erie	Geo. C. Huntington	31	81	2	37	60.0	4.04
Westerville	Franklin	Pf. H. A. Thompson	23	85	11	35	65.2	2.98
Kingston	Ross	Pf. John Haywood	22, 23	88	2	39	63.2	2.82
Portsmouth	Scioto	L. Engelbrecht	22	85	2, 11	42	64.2	2.63
Toledo	Lucas	J. B. Trembly, M. D.	31	90	14	37	63.2	2.19
Hillsboro'	Highland	J. McD. Mathews	22	87	3	36	60.0	4.00
College Hill	Hamilton	I. H. Wilson	22	84	11	35	63.6	2.21
Cincinnati	....do	G. W. Harper	21, 22	87	11	33	64.0	2.34
MICHIGAN.								
Pontiac	Oakland	James A. Weeks	31	86	11	32	59.1	......
Monroe	Monroe	Miss F. E. Whelpley	31	86	10	36	61.6	2.05
Ypsilanti	Washtenaw	C. S. Woodard	23	87	11	35	59.5	3.21
State Agric. College	Ingham	Pf. R. C. Kedzie	20	84	3	34	54.0	2.87
INDIANA.								
Pennville	Jay	Miss Miriam Griest	7, 21, 22, 23, 30, 31	88	3	34	67.7	......
Muncie	Delaware	E. J. Rice	22	90	2	36	64.1	1.15
Spiceland	Henry	Wm. Dawson	22	91	2	34	64.3	2.80
New Albany	Floyd	E. S. Crozier, M.D.	23	88	3	39	63.6	2.72
New Harmony	Posey	John Chappellsmith.	22	88	2, 10	44	66.5	1.98
ILLINOIS.								
Chicago	Cook	A. Byrne	30	78	11	38	58.7	......
Sandwich	De Kalb	N. E. Ballou, M.D	22, 30	90	2, 10	36	61.7	2.72
Ottawa	La Salle	Mrs. E. H. Merwin	22	95	2	36	63.0	1.79
Winnebago	Winnebago	J. W. Tolman	20, 21, 22, 30	90	2	35	61.8	1.46
Du Quoin	Perry	Charles Ziegler	21, 22	94	3	32	63.3	1.60
Tiskilwa	Bureau	Verry Aldrich	22	92	3, 11	34	61.6	......
Peoria	Peoria	Frederick Brendel	20	92	2	39	66.4	1.88

I. MAY, 1864—CURRENT WEATHER—Continued.

Place.	County.	Observer.	Date.	Maximum temp.	Date.	Minimum temp.	Mean temp.	Rain and melted snow.
ILLINOIS—Cont'd.				°		°	°	In.
Pekin	Tazewell	J. H. Riblett	20	91	2	38	65. 5	1. 81
Hoyleston	Washington	J. Ellsworth	21, 22	96	2	39	65. 9	1. 25
Waverly	Morgan	Timothy Dudley	20, 22	90	2	38	64. 2	1. 25
Galesburg	Knox	Prof. W. Livingston	22	86	2	37	63. 7	1. 80
Manchester	Scott	Dr. J. & Miss E Grant	21	91	2	33	65. 0	2. 02
Augusta	Hancock	S. B. Mead, M. D.	22	87	2	35	64. 0	2. 16
WISCONSIN.								
Manitowoc	Manitowoc	Jacob Lüps	30	92	2	31	54. 7	1. 32
Milwaukee	Milwaukee	I. A. Lapham, LL.D.	21	68	2, 7	46	55. 2	2. 74
Green Bay	Brown	Friedrich Deckner	30	92	3	31	56. 7	1. 08
Weyauwega	Waupacca	William Woods	21	96	2, 10	32	58. 7	......
Embarrass	do	J. Everett Breed	30	98	2, 3	25	56. 2	2. 58
Superior	Douglas	....	21	92	13	25	48. 7	1. 24
MINNESOTA.								
St. Paul	Ramsey	Rev. A. B. Paterson	21	88	10	32	59. 0	0. 47
New Ulm	Brown	Charles Roos	21	92	10	35	62. 7	1. 00
IOWA.								
Lyons	Clinton	Dr. P. J. Farnsworth	21	90	2	34	62. 7	3. 50
Dubuque	Dubuque	Asa Horr, M.D.	30	91	10	37	63. 7	2. 50
Muscatine	Muscatine	I. P. Walton	30	90	2	34	56. 1	3. 39
Fort Madison	Lee	Daniel McCready	21	91	2	34	64. 7	2. 43
Iowa City	Johnson	Theo. S. Parvin. A.M.	29, 30	90	2	32	62. 2	3. 60
Mount Pleasant	Henry	Rev. E. L. Briggs	31	90	2	36	63. 8	3. 20
Independence	Buchanan	A. C. Wheaton	21, 30	90	2	35	63. 0	4. 10
Pleasant Plain	Jefferson	T. McConnel	20	96	2	34	64. 2	4. 10
Iowa Falls	Hardin	Nathan Townsend	29	87	10	37	59. 7	3. 50
Algona	Kossuth	Dr. F. & Miss McCoy	30	92	10	32	59. 9	1. 75
Onawa	Monona	Rich'd Stebbins, M.D.	28, 29	90	1, 2	38	60. 2	......
MISSOURI.								
Allenton	St. Louis	A. Fendler	22	97	2	38	65. 7	......
Fox Creek	do	Wm Muir	21	92	2	40	68. 9	7. 00
Athens	Clark	J. T. Caldwell	28	91	7	25	61. 2	......
Canton	Lewis	George P. Ray	21	96	2	37	66. 8	2. 07
Harrisonville	Cass	John Christian	22	90	2	46	70. 6	2. 97
KANSAS.								
Manhattan	Riley	H. L. Denison	30	89	2, 3	32	64. 8	2. 29
Fort Riley	Davis	Elford E. Lee	29, 30	90	10	40	70. 8	0. 95
NEBRASKA TER.								
Elkhorn	Washington	Miss A. M. J. Bowen.	29	94	10	33	63. 6	......
Bellevue	Sarpy	Rev. Wm. Hamilton.	29	88	11	32	60. 6	1. 32
UTAH TERRITORY.								
Great Salt Lake City.	Great Salt Lake	W. W. Phelps	30	82	7, 8	46	63. 5	1. 96
St. George	Washington	H. Pearce	27, 30	90	8	50	68. 5	1. 11
COLORADO TER.								
Montgomery	Parke	James Luttrell	29	65	1, 3, 9	29	42. 5	11. 73

II. MAY—AVERAGES.

States and Territories.	Av. number of places.	Averages, 1854.		Averages, 1855.		Averages, 1856.		Averages, 1857.		Averages, 1858.		Averages, 1859.		Averages for six years.		Averages, 1863.		Averages, 1864.	
		Mean temp.	Mean rain.	Mean temp.	Mean rain.	Mean temp.	Mean rain.	Mean temp.	Mean rain.	Mean temp.	Mean rain.	Mean temp.	Mean rain.	Mean temp.	Mean rain.	Mean temp.	Mean rain.	Mean temp.	Mean rain.
		Deg.	*In.*	*Deg.*	*In.*	*Deg.*	*In.*	*Deg.*	*In.*	*Deg.*	*In.*	*Deg.*	*In.*	*Deg.*	*In.*	*Deg.*	*In.*	*Deg.*	*In.*
Maine	6	54.2	5.49	49.7	3.4	49.6	5.7	51.7	4.1	50.1	3.5	54.7	3.5	51.6	4.33	54.5	3.0	53.4	3.47
New Hampshire	3	59.1	3.06	54.7	1.1	52.4	4.6	54.5	6.0	51.7	3.6	5[illegible].2	2.2	53.9	3.43	55.8	4.5	54.9	4.25
Vermont	4	56.7	1.56	54.2	0.2	51.7	3.0	52.1	4.8	52.3	3.3	57.9	1.8	54.3	2.43	55.6	5.6	56.3	3.95
Massachusetts	12	57.4	4.31	55.1	2.9	52.4	6.3	54.6	5.2	52.8	3.1	57.6	4.8	55.0	4.47	57.6	3.2	58.7	2.35
Rhode Island	1	56.6	4.03	54.3	2.6	53.5	4.1	51.8	4.3	53.4	2.4	56.9	3.4	54.5	3.51	....	....	....	......
Connecticut	4	57.9	4.32	55.3	2.2	53.1	5.5	54.1	5.2	53.1	2.8	57.5	4.0	55.2	4.05	58.2	3.7	60.2	3.28
New York	17	59.3	2.84	56.7	2.8	54.0	3.3	53.9	4.6	54.1	4.4	61.5	2.8	56.6	3.47	58.0	3.7	61.0	4.62
New Jersey	4	62.5	8.23	60.2	2.7	57.3	4.0	56.6	8.1	55.4	4.7	60.6	1.8	58.8	4.87	61.3	2.7	64.7	6.43
Pennsylvania	19	62.4	4.14	61.1	3.0	58.5	2.8	57.7	6.6	57.8	7.4	64.3	2.1	60.3	4.36	60.8	2.5	64.1	6.62
Delaware	1	....	....	....	....	57.8	....	69.2	....	61.7	4.86	....	1.70	62.6	3.28	....	....	....	......
Maryland	4	65.7	2.98	64.0	2.6	62.1	3.5	61.8	6.3	59.0	6.7	64.1	3.5	62.8	4.25	63.5	4.3	67.9	6.19
District of Columbia	1	68.8	2.94	64.2	1.4	55.3	4.2	61.3	5.7	60.9	7.3	64.8	3.9	62.6	4.24	60.0	3.8	68.0	4.62
South Carolina	6	71.5	5.45	72.8	4.3	70.8	4.2	69.5	2.4	72.2	2.8	70.2	2.5	71.2	3.58	....	....	72.0	4.13
Tennessee	2	67.9	4.93	67.5	3.9	63.7	6.3	64.0	5.4	67.4	6.1	69.2	2.5	66.7	4.82	....	....	....	......
Kentucky	4	65.8	5.93	66.2	3.1	64.1	2.5	59.3	6.2	64.4	6.4	69.0	1.7	64.8	4.32	....	....	63.5	4.18
Ohio	20	62.0	5.30	62.4	3.8	60.3	2.9	55.3	5.0	58.8	7.3	65.5	2.6	60.7	4.47	62.6	2.3	62.5	3.17
Michigan	7	58.1	3.44	59.1	1.5	52.9	3.9	52.1	3.3	52.3	6.1	56.9	2.9	55.2	3.49	61.8	....	58.6	2.71
Indiana	5	63.7	5.32	64.5	3.5	61.9	3.0	57.4	4.4	60.7	8.9	67.1	2.2	62.5	4.55	64.5	3.0	64.2	2.50
Illinois	13	63.2	4.49	64.1	5.1	61.0	4.4	56.5	2.9	58.2	8.1	63.3	4.3	61.0	5.67	59.1	3.4	63.4	1.79
Missouri	6	58.8	4.09	60.3	3.1	55.0	3.5	50.4	4.1	52.1	6.8	56.8	4.3	55.6	4.43	56.7	3.9	55.0	1.79
Wisconsin	3	54.2	3.94	60.9	....	58.9	4.2	52.4	2.8	51.7	2.8	53.5	5.6	55.3	3.82	57.3	1.9	60.8	0.74
Iowa	9	60.2	6.01	62.9	3.2	60.8	3.5	56.2	7.3	55.7	7.3	63.2	5.4	59.9	5.42	62.7	3.6	61.3	3.02
Minnesota	2	64.9	3.86	66.8	7.2	62.1	3.0	59.2	3.1	64.0	10.6	68.2	6.6	64.2	5.14	55.3	2.4	66.6	4.01
Nebraska Territory	3	....	....	....	....	....	....	55.8	2.7	61.7	5.2	66.6	8.0	60.7	5.20	69.5	4.9	65.4	1.52
Kansas	3	59.0	....	....	....	....	....	....	....	53.1	4.4	64.6	5.6	58.7	5.00	63.4	....	63.6	......
Utah Territory	1	....	....	....	....	....	....	58.0	0.8	....	....	57.3	1.9	....	....	....	....	....	......
California	2	60.1	0.19	....	....	61.9	1.9	63.6	....	62.3	0.2	63.0	1.3	62.1	0.80	....	....	....	......

I. JUNE, 1864—CURRENT WEATHER.

Place.	County.	Observer.	Date.	Maximum temp.	Date.	Minimum temp.	Mean temp.	Rain or melted snow.
MAINE.				°		°	°	*In.*
Perry	Washington	Wm. D. Dana	25	91	10	43	59.8	0.92
Steuben	....do	J. D. Parker	15	92	10, 11	45	60.6	1.40
Lee	Penobscot	Edwin Pitman	15, 25	92	11	42	65.1	1.64
Belfast	Waldo	George E. Brackett.	26	88	10	50	64.4	0.30
West Waterville	Kennebec	B. F. Wilbur	25	90	4, 8	45	65.7	0.55
Gardiner	....do	Rev. F. Gardiner	25, 26	88	10	47	63.7	0.90
Lisbon	Androscoggin	Asa P. Moore	26	91	10	46	64.5	2.15
Cornish	York	Silas West	19	89	10	39	69.3	0.80
Cornishville	....do	G. W. Guptill	26	92	10	45	66.7	1.18
NEW HAMPSHIRE.								
Stratford	Coos	Branch Brown	19	89	10	36	61.0	1.29
North Littleton	Grafton	Rufus Smith	18, 19, 20, 25	82	11	35	58.5	0.50
Barnstead	Belknap	Charles H. Pitman	25	94	10	43	66.8	0.95
Claremont	Sullivan	Arthur Chase	25	94	10	45	67.0	0.90
Do	....do	Stephen O. Mead	25	92	11	44	65.2	......
VERMONT.								
Lunenburg	Essex	Hiram A. Cutting	26	98	12	34	67.9	1.25
Craftsbury	Orleans	James A. Paddock	19	85	10	36	60.8	1.00
Burlington	Chittenden	Rev. McK. Petty	25, 26	85	10	41	63.2	1.51
Middlebury	Addison	H. A. Sheldon	25	95	11	39	65.8	1.39
MASSACHUSETTS.								
Sandwich	Barnstable	N. Barrows, M. D	25	92	10	44	64.6	1.01
Newbury	Essex	John H. Caldwell	26	96	11, 12	48	67.9	......
Topsfield	....do	A. M. Merriam	26	93	10	42	66.1	1.29
New Bedford	Bristol	Samuel Rodman	26	90	12	51	65.2	1.03
Mendon	Worcester	J. G. Metcalf, M. D	25	94	10	47	67.0	......
Baldwinsville	....do	Rev. E. Dewhurst	25	90	10	41	58.4	1.00
Amherst	Hampshire	Prof. E. S. Snell	25	94	10	47	65.7	1.38
Springfield	Hampden	J. Weatherhead	25, 26	100	11	88	65.4	0.56
Westfield	....do	Rev. E. Davis	25, 26	91	10	46	65.3	0.53
RHODE ISLAND.								
Providence	Providence	Prof. A. Caswell	25	95	10	47	65.6	1.22
CONNECTICUT.								
Pomfret	Windham	Rev. D. Hunt	25	89	10	47	64.6	1.12
Columbia	Tolland	Wm. H. Yeomans	25	96	12	50	69.1	......
Middletown	Middlesex	Prof. Jno. Johnston	25, 26	96	10	48	67.7	3.00
NEW YORK.								
Moriches	Suffolk	Miss N. Smith	25, 26	98	10	49	68.1	2.30
South Hartford	Washington	G. M. Ingalsbe	25	96	11	46	70.2	0.82
North Argyle	....do	George M. Hunt	25	94	11	46	66.3	1.04
Fishkill Landing	Dutchess	Wm. H. Denning	26	95	10	50	68.5	1.24
Garrison's	Putnam	Thomas B. Arden	26	90	11	48	66.0	1.84
White Plains	Westchester	Oliver R. Willis	26	93	11	54	70.5	......
Throg's Neck	....do	F. M. Rogers	26	96	11	51	68.5	2.66
St. F. Xavier's Coll.	New York city	Rev. John Aubier	26	97	10	54	70.5	2.59
Flatbush	Kings	Eli T. Mack	25	96	12	48	66.8	2.75
Schenectady	Schenectady	Robert M. Fuller	25	92	10	46	68.1	0.75
Gouverneur	St. Lawrence	C. H. Russell	25	89	10	39	65.4	0.50
Clinton	Oneida	H. M. Paine, M. D	20	96	10	46	69.5	1.15
South Trenton	....do	Storrs Barrows	......	......	......	......	......	1.71
Oneida	Madison	S. Spooner, M. D	25	92	10	44	62.0	2.08
Theresa	Jefferson	S. O. Gregory	19	88	10	42	63.8	0.77
Oswego	Oswego	Wm. S. Malcolm	21	84	10	45	62.7	0.88
Palermo	....do	E. B. Bartlett	26	95	10	43	65.0	......
Skaneateles	Onondaga	W. M. Beauchamp	25	90	7, 10, 11	42	66.8	......
Auburn	Cayuga	John B. Dill	25	96	10	44	70.7	......
Nichols	Tioga	Robert Howell	25	97	10	43	66.6	......
Palmyra	Wayne	Stephen Hyde	25, 26	92	10	47	68.0	......
Seneca Falls	Seneca	Philo Cowing	25	100	10	45	64.3	......
Rochester	Monroe	Dr. M. M. Mathews	24, 25	93	10	46	67.3	1.57
Wilson	Niagara	E. S. Holmes, DD.S	25	95	10	47	67.6	......
Buffalo	Erie	William Ives	21	96	10	46	66.0	0.91
Jamestown	Chautauqua	Rev. S. W. Roe, M.D.	21	96	12	44	66.8	0.50

I. JUNE 1864—CURRENT WEATHER—Continued.

Place.	County.	Observer.	Date.	Maximum temp.	Date.	Minimum temp.	Mean temp.	Rain or melted snow.
NEW JERSEY.				°		°	°	In.
Passaic Valley	Passaic	William Brooks	26	98	10	48	68.0	2.71
Newark	Essex	W. A. Whitehead	26	95	11	45	67.3	1.90
New Brunswick	Middlesex	Geo. W. Thompson	26	98	11	51	68.5	
Mount Holly	Burlington	M. J. Rhees, M.D.	26	95	11	51	68.9	......
Progress	....do	Thomas J. Beans	26	96	11	53	69.4	1.61
Burlington	....do	John C. Deacon	26	95	11	50	67.3	1.40
Haddonfield	Camden	J. S. Lippincott	26	96	11	53	69.2	2.39
Greenwich	Cumberland	Clarkson Sheppard	26	94	10	50	65.8	0.50
PENNSYLVANIA.								
Nazareth	Northampton	L. E. Ricksecker	26	98	10	48	70.1	......
Philadelphia	Philadelphia	Pf. J. A. Kirkpatrick	26	96	12	51	71.9	2.25
Germantown	....do	Thomas Meehan	25	99	11	58	74.8	......
Fallsington	Bucks	Ebenezer Hance	26	95	10, 11	53	68.7	2.30
Moorland	Montgomery	Anna Spencer	26	93	11	51	67.6	2.40
Mount Joy	Lancaster	J. R. Hoffer	25	100	13	55	74.1	2.10
Berwick	Columbia	John Eggert	25	96	11	50	68.9	1.88
Harrisburg	Dauphin	John Heisely, M.D.	25, 26	95	13	56	72.6	2.68
Tioga	Tioga	E. T. Bentley	22	98	10	41	68.3	1.85
Williamsport	Lycoming	H. C. Moyer	25	91	10	47	67.3	......
Fleming	Centre	Samuel Brugger	24, 25	95	12, 13	46	68.1	1.65
Canonsburg	Washington	Rev. W. Smith, D.D.	25	90	12	41	66.2	4.33
DELAWARE.								
Wilmington	Newcastle	U. D. Hedges, M. D.	25	96	10, 12	55	70.5	1.80
MARYLAND.								
Chestertown	Kent	Prof. J. R. Dutton	26	97	11	55	71.8	1.37
Annapolis	Anne Arundel	Wm. R. Goodman	26	100	11	57	72.7	1.74
St. Mary's	St. Mary's	Rev. J. Stephenson	26	96	12	56	72.7	1.19
Sykesville	Carroll	Miss H. M. Baer	25	92	14	53	64.3	1.50
DIST. OF COLUMBIA.								
Washington	Washington	Smithsonian Inst'n	25	94	14	56	72.1	0.81
SOUTH CAROLINA.								
Hilton Head	Beaufort	Lieut. C. R. Suter	27	92	13, 14	63	74.9	6.01
Beaufort	....do	M. M. Marsh, M. D.	27	100	13, 14	58	77.0	5.90
KENTUCKY.								
Louisville	Jefferson	Mrs. L. Young	25, 26	94	12	48	72.6	3.09
OHIO.								
Saybrook	Ashtabula	James B. Fraser	25, 26	93	10, 11	38	64.6	0.18
East Fairfield	Columbiana	S. B. McMillan	26	91	11	48	66.8	0.89
New Lisbon	....do	J. F. Benners	24, 25	97	11	45	69.1	0.93
Steubenville	Jefferson	Roswell Marsh	....	92	....	40	....	4.95
Welshfield	Geanga	B. F. Abell, A.M.	26	95	10	43	68.1	1.17
Milnersville	Guernsey	Rev. D. Thompson	24, 25	95	12	45	....	2.81
Wooster	Wayne	Martin Winger	26	96	10	47	70.0	......
Norwalk	Huron	Rev. A. Newton	25, 26	94	11, 12	48	66.9	3.04
Westerville	Franklin	Pf. H. A. Thompson	9, 17	88	12	50	68.0	......
Kingston	Ross	Prof. Jno. Haywood	24	95	12	52	72.1	2.04
Portsmouth	Scioto	L. Engelbrecht	26	91	3	53	72.1	2.40
Urbana	Champaign	Prof. M. G. Williams	26	95	2, 11	48	70.3	3.82
Hillsborough	Highland	J. McD. Mathews	25	91	12	49	69.8	3.37
Bethel	Clermont	George W. Crane	26	95	12, 13, 14	50	71.5	6.88
College Hill	Hamilton	I. H. Wilson	24, 25	92	13	54	74.3	4.38
Do.	....do	John W. Hammitt	26	94	13	54	74.8	3.13
Cincinnati	....do	G. W. Harper	25	98	13	53	75.0	3.43
MICHIGAN.								
Pontiac	Oakland	James A. Weeks	21, 24, 25, 26	90	10	46	67.0	......
Monroe City	Monroe	Miss F. E. Whelpley	18	93	10, 11	50	68.1	5.05
Ypsilanti	Washtenaw	C. S. Woodard	25	93	12	46	68.3	3.82
Agricultural College	Ingham	Prof. R. C. Kedzie	24	95	1, 6, 13	48	67.7	3.88

I. JUNE, 1864—CURRENT WEATHER—Continued.

Place.	County.	Observer.	Date.	Maximum temp.	Date.	Minimum temp.	Mean temp.	Rain or melted snow.
INDIANA.				°		°	°	*In.*
Pennville	Jay	Miriam Griest	17, 18, 24, 30	96	12, 13	46	72.0	......
Muncie	Delaware	E. J. Rice	26	97	11	54	74.3	0.25
Spiceland	Henry	William Dawson	25, 26	97	1, 13	53	73.0	1.40
New Castle	...do	T. B. Redding, A.M	26, 30	93	13	51	71.5	1.24
New Albany	Floyd	E. S. Crozier, M.D	26	95	12	54	72.0	3.03
South Bend	St. Joseph	Reuben Burroughs	18, 25, 26	95	10	45	71.1	1.27
Indianapolis	Marion	Royal Mayhew	25, 26	95	11, 13	54	72.5	1.78
Bloomingdale	Parke	W. H. Hobbs	29	92	13	54	75.2	......
New Harmony	Posey	John Chappellsmith	29	96	11	56	76.5	0.93
ILLINOIS.								
Riley	McHenry	E. Babcock	25	93	10, 11	44	67.1	2.81
Sandwich	De Kalb	N. E. Ballou, M. D	29	96	10	43	69.4	2.37
Ottawa	La Salle	Mrs. E. H. Merwin	29	101	11	42	69.9	1.52
Tiskilwa	Bureau	Verry Aldrich	30	96	10	42	70.0	......
Wyanet	...do	E. S. Phelps, jr	29	93	7	38	78.2	......
Hennepin	Putnam	Smiley Shepherd	29, 30	94	7	36	69.0	......
Peoria	Peoria	Friedrich Brendel	26	95	12	52	73.9	2.55
Pekin City	Tazewell	J. H. Riblett	26, 29, 30	94	11, 12	50	73.8	2.80
Hoyleston	Washington	J. Ellsworth	30	103	11	49	78.8	3.00
Waverly	Morgan	Timothy Dudley	26, 30	96	11	48	73.2	0.60
Galesburg	Knox	Prof. W. Livingston	26, 30	89	11	50	68.4	4.80
Manchester	Scott	Dr. J. and Miss Grant	29	96	11	49	73.5	1.12
Augusta	Hancock	S. B. Mead, M.D	30	94	7	49	72.3	1.37
WISCONSIN.								
Manitowoc	Manitowoc	Jacob Lüps	25, 26	92	11	42	61.2	1.44
Milwaukee	Milwaukee	I. A. Lapham, LL.D.	24	97	7	39	65.2	0.15
Do	...do	Carl Winkler	25	97	6, 10	45	70.0	0.01
Green Bay	Brown	Friedrich Deckner	23	95	10	43	67.5	0.94
Geneva	Walworth	Wm. H. Whiting	23, 24	90	10	42	65.2	......
Embarrass	Waupacca	J. Everett Breed	19, 22, 23, 24	98	11, 13	32	66.5	1.82
Waupacca	...do	H. C. Mead	23	98	6, 10, 11	50	72.8	......
Lebanon	...do	J. C. Hicks	18	98	6	44	69.7	......
Superior	Douglas	Thomas Clark	24	94	1, 3, 12	45	64.0	3.62
MINNESOTA.								
Beaver Bay	Lake	C. Wieland	25	96	6	42	57.4	1.29
St. Paul	Ramsey	Rev. A. B. Paterson	22, 25	91	6	46	69.7	1.62
Tamarack	Hennepin	Mary A. Grave	22	95	6	54	....	......
New Ulm	Brown	Charles Roos	25	97	5	49	73.7	2.38
IOWA.								
Lyons	Clinton	Dr. P. J. Farnsworth	21, 29	92	7, 10, 11	48	70.6	3.45
Dubuque	Dubuque	Asa Horr, M.D	21	93	11	52	72.3	3.69
Independence	Buchanan	A. C. Wheaton	23, 24	94	10. 13	50	71.8	7.80
Iowa City	Johnson	Theo. Parvin, A.M	29	93	7	46	70.6	5.70
Mount Pleasant	Henry	Rev. E. L. Briggs	26, 29	94	1, 6, 11, 12	52	73.1	0.77
Fort Madison	Lee	Daniel McCready	25	95	7	47	74.2	2.01
Waterloo	Black Hawk	T. Steed	21, 23, 24, 26	90	2	50	69.3	4.56
Pleasant Plain	Jefferson	T. McConnel	22	100	2	44	74.5	3.05
Iowa Falls	Hardin	N. Townsend	21, 22	90	6, 12	44	69.8	8.25
Algona	Kossuth	Dr. & Miss L. McCoy	21	98	1, 2, 4	52	71.2	3.62
Onawa	Monona	Rich. Stebbins, M.D	20, 21, 26	97	6	50	74.1	......
MISSOURI.								
Allenton	St. Louis	Augs. Fendler	30	103	13	52	75.2	......
Fox Creek	...do	William Muir	28, 30	96	12	55	76.2	2.10
Athens	Clark	J. T. Caldwell	29	99	2	22	74.5	1.25
Canton	Lewis	George P. Ray	30	104	1	51	74.6	1.12
Harrisonville	Cass	John Christian	20, 21	98	12	57	77.2	2.38
KANSAS.								
Olatha	Johnson	W. Beckwith	21	104	2	49	....	2.63
Manhattan	Riley	H. L. Denison	21	100	6	50	75.8	2.06
Fort Riley	Davis	Elford E. Lee	21, 29, 30	99	6	54	78.1	1.88

I. JUNE, 1864—CURRENT WEATHER—Continued.

Place.	County.	Observer.	Date.	Maximum temp.	Date.	Minimum temp.	Mean temp.	Rain.
NEBRASKA TERR.				°		°	°	*In.*
Elkhorn City	Washington	Miss A. M. J. Bowen	21	101	6	50	74.9	.....
Bellevue	Sarpy	Rev. Wm. Hamilton	20	95	1, 6	53	73.7	2.86
UTAH TERRITORY.								
St. George	Washington	H. Pearce	9, 30	98	22	58	78.0	......
Great Salt Lake City.	Great Salt Lake	W. W. Phelps	25, 26	87	13, 14	53	68.6	1.50
OREGON.								
Auburn	Baker	S. M. W. Hindman	29	76	18	44	....	2.50
CALIFORNIA.								
Sacramento	Sacramento	T. W. Logan, M.D.	30	96	17, 18	58	71.5	0.09

II. JUNE—AVERAGES.

States and Territories.	Av. number of places.	Averages, 1854.		Averages, 1855.		Averages, 1856.		Averages, 1857.		Averages, 1858.		Averages, 1859.		Averages for six years.		Averages, 1863.		Averages, 1864.	
		Mean temp.	Mean rain.	Mean temp.	Mean rain.	Mean temp.	Mean rain.	Mean temp.	Mean rain.	Mean temp.	Mean rain.	Mean temp.	Mean rain.	Mean temp.	Mean rain.	Mean temp.	Mean rain.	Mean temp.	Mean rain.
		Deg.	*In.*	*Deg.*	*In.*	*Deg.*	*In.*	*Deg.*	*In.*	*Deg.*	*In.*	*Deg.*	*In.*	*Deg.*	*In.*	*Deg.*	*In.*	*Deg.*	*In.*
Maine	6	62.6	3.93	61.7	6.1	63.8	2.9	59.3	3.7	63.3	2.1	60.3	7.2	62.0	4.32	60.6	2.3	64.4	1.09
New Hampshire	3	65.4	2.56	63.9	3.8	67.2	2.0	61.8	3.3	67.4	2.3	53.7	5.1	63.2	3.18	60.9	2.7	63.7	0.91
Vermont	4	64.7	2.31	60.7	8.4	66.3	2.5	61.2	4.9	67.6	3.8	62.0	4.0	63.8	4.30	61.3	2.1	64.4	1.29
Massachusetts	12	66.2	2.97	54.3	4.0	66.6	3.0	62.5	2.5	66.9	4.7	63.6	6.5	63.4	3.91	61.7	1.8	65.1	0.97
Rhode Island	1	65.6	2.85	65.3	2.0	67.8	2.5	62.0	1.9	57.7	5.6	63.7	7.7	65.4	3.73	......	......	65.6	1.22
Connecticut	4	66.4	3.43	64.8	4.1	67.4	2.7	62.1	3.1	62.1	3.9	62.9	7.3	64.3	4.16	57.6	......	67.1	2.06
New York	17	67.8	2.81	63.2	5.5	68.3	3.1	63.4	6.8	69.7	4.1	62.9	4.0	65.9	4.39	62.5	1.9	66.1	1.53
New Jersey	4	70.5	2.87	68.8	5.5	72.2	2.8	67.0	6.6	72.8	4.2	67.3	3.5	69.8	4.23	66.2	10.5	68.1	1.75
Pennsylvania	19	71.1	3.36	67.3	8.2	72.5	2.9	67.4	7.4	73.6	4.4	67.7	3.7	69.9	4.98	68.5	3.6	69.1	2.38
Delaware	1	......	......	68.9	......	......	......	69.9	......	76.4	2.3	......	7.4	71.7	4.80	......	......	70.5	1.80
Maryland	4	72.7	3.10	70.8	5.7	75.0	3.0	72.4	8.3	73.8	3.8	69.7	3.6	70.7	4.60	67.6	2.7	70.4	1.45
District of Columbia	1	74.9	2.34	71.2	5.6	74.7	5.9	71.6	6.5	76.4	1.4	71.4	5.0	73.3	4.47	70.2	2.6	72.1	0.81
South Carolina	5	79.7	4.71	75.5	5.8	78.9	3.8	78.1	2.6	81.8	2.2	76.6	4.6	78.5	3.95	......	......	75.9	5.95
Tennessee	2	75.1	5.15	70.9	5.1	77.6	1.2	73.9	3.6	75.1	5.8	75.2	4.4	74.7	4.19	......	......	......	......
Kentucky	4	72.8	2.65	70.8	6.1	76.7	2.8	69.7	4.9	74.8	4.1	72.0	3.3	72.8	3.94	......	......	72.6	3.09
Ohio	20	70.8	3.05	68.5	8.5	73.0	3.4	67.5	5.2	72.9	5.2	66.8	4.4	69.9	5.01	61.5	1.9	60.2	2.89
Michigan	7	69.3	4.81	63.5	8.4	68.8	4.6	63.4	3.7	70.1	3.9	61.3	3.3	66.1	4.89	62.7	10.8	67.8	4.25
Indiana	5	52.3	3.81	68.6	5.2	76.5	2.1	68.0	4.7	73.5	5.6	69.9	4.7	71.5	4.39	66.6	2.6	73.1	1.41
Illinois	14	71.7	2.03	67.8	2.8	75.1	2.6	62.6	3.9	72.8	5.8	66.6	2.9	69.5	3.34	67.3	1.5	72.1	2.29
Wisconsin	6	69.4	6.42	63.7	3.9	64.5	4.1	62.1	4.5	69.0	5.3	62.3	5.1	65.2	4.90	61.4	1.2	66.9	1.33
Minnesota	3	66.8	2.69	66.7	5.0	67.4	2.8	64.5	4.1	67.7	2.8	59.8	6.5	65.5	3.95	61.9	0.3	66.9	1.43
Iowa	9	70.7	4.14	68.4	5.0	73.5	1.9	68.3	1.8	72.2	6.4	66.2	5.6	69.9	4.11	68.6	1.5	72.0	4.29
Missouri	2	75.0	1.09	71.6	4.3	79.5	1.1	70.6	2.6	76.5	6.7	72.5	11.0	74.3	4.52	72.7	0.7	75.5	1.71
Kansas	3	......	......	......	......	......	......	72.1	1.1	74.9	8.3	73.2	5.8	73.4	5.10	71.5	5.9	76.9	2.19
Nebraska Territory	3	67.7	......	......	......	......	......	70.6	3.3	74.5	7.1	71.0	2.8	70.0	4.30	67.7	2.8	74.3	2.86
California	2	65.1	0.57	......	......	69.3	0.0	66.5	0.2	68.1	0.1	72.4	1.3	68.3	0.43	......	......	71.5	0.09

I. JULY, 1864—CURRENT WEATHER.

Place.	County.	Observer.	Date.	Maximum temp.	Date.	Minimum temp.	Mean temp.	Rain.
MAINE.				°		°	°	*In.*
Perry	Washington	Wm. D. Dana	27	86	1	45	63.8	1.33
Steuben	...do	J. D. Parker	31	84	16, 23, 28	57	......	1.15
Blue Hill	Hancock	H. H. Osgood	31	91	1	50	67.8	......
Lee	Penobscot	Edwin Pitman	14, 19, 20	90	22	47	69.6	1.87
Gardiner	Kennebec	Rev. F. Gardiner	20, 31	88	1, 2, 3, 22, 23, 28	58	68.0	0.59
West Waterville	...do	B. F. Wilbur	20, 31	88	22	58	70.8	1.35
Lisbon	Androscoggin	Asa P. Moore	31	93	2, 28	56	69.1	0.62
Cornish	York	Silas West	19	92	2	50	67.5	0.60
Cornishville	...do	G. W. Guptill	19	93	2	55	72.0	0.66
NEW HAMPSHIRE.								
Stratford	Coos	Branch Brown	19	88	22	50	65.0	3.05
Shelburn	...do	F. Odell	19	98	28	48	72.8	......
North Littleton	Grafton	Rufus Smith	19	87	22, 23	47	64.5	1.50
Barnstead	Belknap	Chas. H. Pitman	19	95	2	55	71.5	0.85
Claremont	Sullivan	Arthur Chase	20	95	22	50	73.0	1.80
Do	...do	Stephen O. Mead	19	94	9, 22	54	71.4	......
VERMONT.								
Lunenburg	Essex	H. A. Cutting	19	95	22	41	72.0	2.00
Craftsbury	Orleans	James A. Paddock	18	89	22	50	65.5	2.76
Calais	Washington	James K. Tobey	19	89	22	48	67.7	......
Burlington	Chittenden	Rev. McK. Petty	19, 31	85	22	53	68.3	2.85
Middlebury	Addison	H. A. Sheldon	31	94	22	55	72.5	1.25
MASSACHUSETTS.								
Sandwich	Barnstable	N. Barrows, M. D.	27	86	14, 15, 22	58	69.3	1.73
Newbury	Essex	John H. Caldwell	20	93	22	55	70.6	......
Topsfield	...do	A. N. Merriam	20, 31	90	14	54	69.9	1.16
New Bedford	Bristol	Samuel Rodman	29	82	22	57	67.0	1.45
Mendon	Worcester	J. G. Metcalf, M. D.	20	90	22	53	71.4	1.80
Baldwinsville	...do	Rev. E. Dewhurst	19	87	22	52	69.2	1.42
Worcester	...do	H. C. Prentiss	2, 3, 31	88	22	58	67.8	1.68
Amherst	Hampshire	Prof. E. S. Snell	20	92	26	54	71.5	0.96
Springfield	Hampden	J. Weatherhead	31	100	22	45	72.1	1.22
Westfield	...do	Rev. E. Davis	11, 20, 31	90	23	53	71.4	1.44
CONNECTICUT.								
Pomfret	Windham	Rev. D. Hunt	31	86	22	57	69.7	2.20
Columbia	Tolland	Wm. H. Yeomans	31	94	22	56	74.2	......
Middletown	Middlesex	Prof. John Johnston	31	96	23	54	73.4	1.68
Colebrook	Litchfield	Charlotte Rockwell	20, 31	92	22	53	71.2	......
NEW YORK.								
South Hartford	Washington	G. M. Ingalsbe	18, 31	93	23	61	75.4	1.95
North Argyle	...do	George M. Hunt	19	92	21	52	71.4	2.96
Fishkill Landing	Dutchess	Wm. H. Denning	11, 17, 19, 20, 31	90	22	58	71.8	2.37
Garrison's	Putnam	Thos. B. Arden	6, 20	85	22, 23	59	72.0	2.85
Throg's Neck	Westchester	F. M. Rogers	31	92	22	61	67.3	2.11
Deaf and Dumb Asy.	New York city	Prof. O. W. Morris	31	92	25	65	78.5	3.20
St. F. Xavier's Coll.	...do	Rev. J. M. Aubier	28, 31	91	22	60	75.4	1.20
Flatbush	Kings	Eli T. Mack	31	93	23	59	74.2	2.30
Schenectady	Schenectady	Harman V. Swart	11, 19, 20, 31	94	22	59	75.6	......
Gouverneur	St. Lawrence	C. H. Russell	18, 19	92	22	54	71.1	0.74
Clinton	Oneida	H. M. Paine, M. D.	19	100	22	56	75.6	2.39
South Trenton	...do	Storrs Barrows	......	......	......	......	......	2.70
Theresa	Jefferson	S. O. Gregory	18	93	22	56	71.1	0.76
Oswego	Oswego	Wm. S. Malcolm	18	88	4	58	68.9	1.00
Palermo	...do	E. B. Bartlett	18, 19, 31	97	23	54	76.6	......
Skaneateles	Onondaga	W. M. Beauchamp	31	93	22	51	71.3	......
Auburn	Cayuga	John B. Dill	18, 19, 31	98	22, 23	60	78.8	......
Nichols	Tioga	Robert Howell	1, 20	96	22, 23	50	73.1	......
Palmyra	Wayne	Stephen Hyde	18	96	22	56	74.1	......
Rochester	Monroe	M.M. Matthews, M.D.	19, 31	94	23	57	73.3	1.66
Wilson	Niagara	E. S. Holmes, DD.S.	31	100	2, 21, 25	62	75.0	......
Buffalo	Erie	William Ives	18	96	22	58	73.3	1.50
Jamestown	Chautauqua	Rev. S. W. Roe, M.D.	31	97	22	50	72.2	4.50

I. JULY, 1864—CURRENT WEATHER—Continued.

Place.	County.	Observer.	Date.	Maximum temp.	Date.	Minimum temp.	Mean temp.	Rain.
NEW JERSEY.				°		°	°	In.
Newark	Essex	W. A. Whitehead	31	90	23	53	72.5	3.74
Mount Holly	Burlington	M. J. Rhees, M. D.	31	89	23	56	72.1	......
Progress	....do	Thomas J. Beans	31	94	22	59	74.9	3.07
Burlington	....do	John C. Deacon	11	89	23	52	73.2	2.20
Haddonfield	Camden	Jas. S. Lippincott	31	91	23	58	74.4	3.12
Greenwich	Cumberland	Clarkson Sheppard	12	88	22	51	71.1	2.14
PENNSYLVANIA.								
Nazareth	Northampton	L. E. Ricksecker	29, 31	96	23, 24	56	76.1	......
Philadelphia	Philadelphia	Pf. J. A. Kirkpatrick.	31	94	22	61	77.6	3.64
Germantown	....do	Thomas Meehan	1, 31	96	6	61	....	......
Fallsington	Bucks	Ebenezer Hance	31	91	23	57	75.0	2.10
Moorland	Montgomery	Miss Anna Spencer	31	91	22, 23	54	72.7	4.47
Silver Spring	Lancaster	H. G. Bruckhart	30, 31	94	22	54	76.0	......
Mount Joy	....do	J. R. Hoffer	31	101	23	60	80.6	1.85
Berwick	Columbia	John Eggert	31	94	23	55	74.4	2.44
Harrisburg	Dauphin	John Heisely, M. D	30	92	23	61	78.3	5.18
Tioga	Tioga	E. T. Beutley	31	100	23	48	74.2	2.50
Connellsville	Fayette	John Taylor	17, 19	94	22	50	77.5	......
Pennsville	Clearfield	Elisha Fenton	17	99	4, 23	45	71.6	4.16
Blairsville	Indiana	W. R. Boyers	20, 27	95	1	50	73.0	6.00
Canonsburg	Washington	Rev. W. Smith, D.D.	30	90	23	47	71.0	2.83
DELAWARE.								
Wilmington	Newcastle	U. D. Hedges, M. D.	28, 29, 31	94	22	58	76.8	4.00
MARYLAND.								
Chestertown	Kent	Prof. J. R. Dutton	31	96	22	63	78.2	1.05
Annapolis	Anne Arundel	Wm. R. Goodman	26	100	11	67	72.7	1.74
St. Mary's	St. Mary's	Rev. J. Stephenson	8, 30	92	4	65	78.8	0.93
Sykesville	Carroll	Miss H. M. Baer	29, 30	90	22	55	74.7	1.25
DIST. OF COLUMBIA.								
Washington	Washington	Smithsonian Instit'n.	29, 31	93	23	59	77.9	1.37
SOUTH CAROLINA.								
Hilton Head	Beaufort	Lieut. C. R. Suter	2	101	25	70	83.9	4.29
KENTUCKY.								
Louisville	Jefferson	Mrs. L. Young	29	96	23	47	79.6	2.13
OHIO.								
Austinburg	Ashtabula	David S. Alvord	19	92	3	57	74.0	3.43
East Fairfield	Columbiana	S. B. McMillan	18	93	23	51	73.9	1.31
Welshfield	Geauga	B. F. Abell, A. M	31	94	22	56	74.5	5.13
Milnersville	Guernsey	Rev. D. Thompson	30	99	22	46	....	0.60
Cleveland	Cuyahoga	Mr. and Mrs. Hyde	18	92	23	61	75.0	1.66
Wooster	Wayne	Martin Winger	30	96	22	55	76.2	......
Kelley's Island	Erie	Geo. C. Huntington	29, 30	90	22	65	76.2	4.81
Gallipolis	Gallia	A. P. Rogers	30	94	22	54	74.6	2.70
Norwalk	Huron	Rev. A. Newton	30	91	22	56	72.8	3.53
Kingston	Ross	Prof. Jno. Haywood.	30	98	22	60	78.2	1.60
Portsmouth	Sciota	L. Engelbrecht	30	92	23	55	78.2	0.48
Urbana	Champaign	Prof. M. G. Williams.	29, 30	95	22	55	74.5	0.84
Hillsborough	Highland	J. McD. Matthews	30	97	23	56	75.6	1.63
College Hill	Hamilton	I. H. Wilson	30	94	23	62	78.1	3.10
Do	....do	John W. Hammitt	30	98	23	60	79.6	3.00
Cincinnati	....do	G. W. Harper	30	99	23	57	79.6	1.25
MICHIGAN.								
Pontiac	Oakland	Jas. A. Weeks	30	93	4, 22	56	72.9	......
Monroe City	Monroe	Miss F. E. Whelpley.	29	88	22	62	73.8	1.07
Ypsilanti	Washtenaw	C. S. Woodard	30	95	22	59	....	1.79
Agricultural College.	Ingham	Prof. R. C. Kedzie	29, 30	96	22	56	74.5	1.25
INDIANA.								
Pennville	Jay	Miriam Griest	29	99	21	56	76.7	......
Spiceland	Henry	William Dawson	30	100	22	58	77.2	2.10
Newcastle	....do	Thos. B. Redding	29	97	5	58	....	0.51

I. JULY, 1864—CURRENT WEATHER—Continued.

Place.	County.	Observer.	Date.	Maximum temp.	Date.	Minimum temp.	Mean temp.	Rain.
INDIANA—Con'd.				°		°	°	In.
Madison	Jefferson	Rev. Samuel Collins.	30	95	5, 25, 26, 27	68	82.0	0.75
New Albany	Floyd	E. S. Crozier, M.D.	11, 29	95	23, 24	58	78.4	0.28
South Bend	St. Joseph	Reuben Burroughs	30	96	22	57	72.7	2.58
Indianapolis	Marion	Royal Mayhew	29	97	23	58	77.3	0.43
Rensselaer	Jasper	J.H. Loughridge, M.D	30	95	......	......	......	......
New Harmony	Posey	John Chappellsmith.	1	96	23	62	80.4	2.49
ILLINOIS.								
Evanston	Cook	H. W. Scovill	29, 30	91	1	60	71.4	3.55
Riley	McHenry	E. Babcock	30	92	21	56	72.2	11.12
Sandwich	De Kalb	N. E. Ballou, M.D.	29, 30	95	21	51	74.5	8.78
Ottawa	La Salle	Mrs. E. H. Merwin	9	104	21	55	76.0	2.94
Winnebago	Winnebago	James W. Tolman	30	94	21	59	74.0	5.83
Tiskilwa	Bureau	Verry Aldrich	19	98	21, 22, 23	62	75.2	......
Wyanet	....do	E. S. Phelps, jr	29	97	22	49	86.6	......
Hennepin	Putnam	Smiley Sheppard	30	95	22	50	74.4	......
Peoria	Peoria	Frederick Brendel	29	98	22	59	78.0	2.92
Pekin City	Tazewell	J. H. Riblett	29	97	24	57	77.6	5.04
Hoyleston	Washington	J. Ellsworth	17, 18, 29	100	22	60	81.2	6.00
Waverly	Morgan	Timothy Dudley	19	97	22	62	79.0	2.15
Galesburg	Knox	Prof. W. Livingston.	17, 29	92	2	60	75.3	3.40
Manchester	Scott	Dr. J. & Miss E. Grant	19	97	21, 22	61	77.9	2.03
WISCONSIN.								
Milwaukee	Milwaukee	I. A. Lapham, LL.D.	30	94	22	52	71.3	7.07
Green Bay	Brown	Friedrich Deckner	30	94	2, 21	56	72.6	3.22
Geneva	Walworth	Wm. H. Whiting	9, 29, 30	89	1	56	72.7	......
Embarrass	Waupacca	J. Everett Breed	30	99	3	40	72.0	3.35
Waupacca	....do	H. C. Mead	29, 30	96	1, 21	60	76.3	......
Beloit	Rock	William Porter	29	94	21	58	73.8	6.63
MINNESOTA.								
St. Paul	Ramsey	Rev. A. B. Paterson.	29, 30	92	2	55	73.3	4.01
Tamarack	Hennepin	Mary A. Grave	29, 30	93	21	65	......	......
IOWA.								
Lyons	Clinton	Dr. P. J. Farnsworth.	19, 29	96	22	58	75.3	4.85
Dubuque	Dubuque	Asa Horr, M. D.	17	96	22	60	77.0	2.02
Monticello	Jones	Chauncey Mead	16	95	21	58	75.0	3.29
Muscatine	Muscatine	I. P. Walton	18	96	21	55	75.3	3.25
Independence	Buchanan	A. C. Wheaton	19, 29	98	21, 22	57	76.1	8.80
Do	....do	D. S. Deering	17	98	2, 21, 22	62	76.0	......
Iowa City	Johnson	T. S. Parvin, A.M.	17, 29	94	3	55	76.0	4.85
Mount Pleasant	Henry	Rev. E. L. Briggs	17	99	22	60	78.0	6.25
Waterloo	Black Hawk	T. Steed	18	94	2	58	76.9	2.75
Iowa Falls	Hardin	N. Townsend	18	91	2	59	69.7	5.70
Algona	Kossuth	Dr. and Miss McCoy.	28	97	2	56	74.1	4.13
Onawa	Manona	Rich'd Stebbins, M.D.	18	97	21, 23	58	76.6	......
MISSOURI.								
Allenton	St. Louis	Augs. Fendler	6, 18	100	24	54	77.3	0.14
Athens	Clark	J. T. Caldwell	17	102	23	65	81.7	......
Canton	Lewis	George P. Ray	9	100	23	58	79.4	7.48
Harrisonville	Cass	John Christian	10	101	22	64	82.8	3.50
NEBRASKA TER.								
Elkhorn City	Washington	Miss A. M. J. Bowen.	18	100	2	60	77.1	......
Bellevue	Sarpy	Rev. Wm. Hamilton.	17, 18	93	2	60	77.9	0.74
KANSAS.								
Olatha	Johnson	W. Beckwith	6, 9, 18, 28	99	23	55	......	5.36
Manhattan	Riley	H. L. Denison	7, 18	101	23	61	82.0	3.02
Fort Riley	Davis	Elford E. Lee	18	104	12	69	85.3	2.28

11. JULY—AVERAGES.

States and Territories.	Av. number of places.	Averages, 1854.		Averages, 1855.		Averages, 1856.		Averages, 1857.		Averages, 1858.		Averages, 1859.		Averages for six years.		Averages, 1853.		Averages, 1864.	
		Mean temp.	Mean rain.	Mean temp.	Mean rain.	Mean temp.	Mean rain.	Mean temp.	Mean rain.	Mean temp.	Mean rain.	Mean temp.	Mean rain.	Mean temp.	Mean rain.	Mean temp.	Mean rain.	Mean temp.	Mean rain.
		Deg.	*In.*	*Deg.*	*In.*	*Deg.*	*In.*	*Deg.*	*In.*	*Deg.*	*In.*	*Deg.*	*In.*	*Deg.*	*In.*	*Deg.*	*In.*	*Deg.*	*In.*
Maine	6	70.0	1.73	67.9	6.6	69.3	4.4	67.2	3.6	65.7	6.6	67.3	2.4	67.4	3.54	69.7	6.82	68.3	1.02
New Hampshire	4	72.7	1.82	71.8	4.7	71.4	2.5	71.5	4.3	67.5	4.1	65.9	3.5	70.1	3.14	69.2	7.77	69.7	1.80
Vermont	4	73.7	1.07	69.6	6.2	71.2	3.1	70.7	5.0	67.8	4.9	66.5	1.6	69.9	3.68	69.2	7.77	69.0	2.22
Massachusetts	12	74.5	4.29	71.4	5.8	71.3	2.6	70.2	4.7	69.2	4.5	68.7	2.1	70.9	3.97	70.8	9.43	70.0	1.43
Rhode Island	1	72.9	2.45	72.9	3.3	72.1	4.2	69.9	3.5	69.8	4.9	69.2	1.1	71.2	3.41	......	......	......	......
Connecticut	4	73.4	4.57	71.8	5.8	72.7	2.7	69.7	6.8	69.5	3.5	68.1	2.0	70.9	4.26	70.4	11.16	72.1	1.94
New York	18	75.9	2.30	72.1	4.8	73.3	2.9	72.0	4.1	71.9	4.6	69.2	3.3	72.4	3.72	72.2	5.67	73.5	2.28
New Jersey	4	76.7	4.11	76.2	4.5	77.2	1.4	73.0	6.1	74.4	3.4	72.0	4.0	75.0	4.02	75.8	5.97	73.0	2.83
Pennsylvania	20	78.3	3.03	76.4	5.8	76.7	2.1	70.2	3.6	76.1	3.1	73.4	2.8	75.1	3.42	73.6	5.99	75.2	3.52
Delaware	1	......	......	......	......	......	......	75.5	3.8	80.4	1.3	......	2.8	78.0	5.40	......	......	76.8	4.00
Maryland	5	80.0	1.81	77.0	3.2	78.9	3.6	74.3	4.4	77.2	3.0	74.5	2.5	77.0	3.05	76.7	8.05	76.1	1.24
District of Columbia	1	81.2	1.09	79.0	4.1	79.1	3.9	74.7	5.4	78.3	5.0	76.1	1.6	78.0	3.52	76.4	8.37	77.9	1.37
South Carolina	5	80.0	8.26	80.9	4.2	81.6	3.4	77.4	7.9	80.1	6.6	78.9	4.2	79.8	5.79	......	......	83.9	4.29
Tennessee	2	81.7	2.99	77.5	5.8	78.8	1.9	73.1	4.6	79.1	6.9	79.5	1.3	78.3	3.92	......	......	......	......
Kentucky	4	80.9	1.60	78.1	3.0	79.4	3.0	73.6	4.7	78.5	4.8	78.2	2.3	78.1	3.27	......	......	79.6	2.13
Ohio	18	79.2	2.88	74.7	5.8	76.0	2.7	74.5	4.9	75.9	5.0	74.4	1.6	75.8	3.73	73.3	3.20	76.1	2.34
Michigan	8	76.9	2.04	76.1	8.8	72.3	2.3	71.6	2.9	72.9	2.3	70.7	1.8	73.4	3.34	65.6	2.83	73.7	1.37
Indiana	4	80.2	2.84	77.7	7.0	79.3	2.2	74.2	2.8	77.4	3.1	77.8	1.9	77.8	3.31	73.8	3.94	77.8	1.31
Illinois	13	79.6	1.47	76.3	6.2	77.3	3.6	76.3	2.1	75.3	5.9	75.8	1.7	76.8	3.50	72.6	3.87	76.7	4.89
Wisconsin	9	76.2	7.87	72.0	3.7	68.3	2.6	67.1	2.4	70.9	5.3	73.0	2.2	71.3	3.98	68.6	2.65	72.7	5.07
Minnesota	3	70.7	5.83	70.2	......	72.8	2.7	76.3	1.0	68.7	8.8	70.0	4.2	71.5	4.53	68.5	0.63	73.3	4.01
Iowa	8	66.7	3.48	74.3	4.8	75.6	3.8	63.6	2.9	73.9	8.3	75.7	4.3	71.6	4.58	72.5	3.44	75.5	4.59
Missouri	2	83.1	1.09	79.6	5.2	81.6	4.9	76.8	3.3	82.2	2.9	78.9	5.5	80.4	3.85	76.9	1.64	80.2	3.71
Kansas	4	......	......	......	......	......	......	81.2	3.2	80.6	6.0	80.7	3.7	80.8	4.30	76.3	2.33	83.6	3.55
Nebraska Territory	2	......	......	......	......	......	......	76.7	1.7	76.8	15.8	77.7	1.8	77.1	6.40	71.8	2.25	77.5	0.74
California	2	73.6	0.03	......	......	73.5	0.1	60.7	0.0	69.4	0.0	66.9	1.3	68.8	0.25	......	......	......	......

I. AUGUST, 1864—CURRENT WEATHER.

Place.	County.	Observer.	Date.	Maximum temp.	Date.	Minimum temp.	Mean temp.	Rain.
MAINE.				°		°	°	*In.*
Perry	Washington	Wm. D. Dana	14	80	4	54	62.2	5.54
Steuben	....do	J. D. Parker	14	82	31	51	64.0	3.10
Lee	Penobscot	Edwin Pitman	1	90	6, 8, 21, 31	56	67.8	1.85
West Waterville	Kennebec	B. F. Wilbur	1	93	30, 31	57	68.7	3.90
Lisbon	Androscoggin	Asa P. Moore	10	89	30	55	68.3	4.88
Cornish	York	Silas West	1	96	20	52	65.6	8.30
Cornishville	....do	G. W. Guptill	1	97	31	56	70.7	8.24
NEW HAMPSHIRE.								
Stratford	Coos	Branch Brown	1	90	19	51	65.3	5.75
Shelburne	....do	F. Odell	15	88	19	51	68.0	......
Barnstead	Belknap	Charles H. Pitman	1	96	29, 31	60	70.9	4.75
Claremont	Sullivan	S. O. Mead	1	97	19	54	70.3	......
Do	....do	Arthur Chase	13	90	20	50	70.0	7.05
VERMONT.								
Lunenburg	Essex	Hiram A. Cutting	1	100	29, 31	48	....	3.30
Craftsbury	Orleans	James A. Paddock	1	89	30, 31	50	64.5	4.89
Burlington	Chittenden	Rev. McK. Petty	1	87	19	50	66.8	5.86
Middlebury	Addison	H. A. Sheldon	1	94	31	55	70.4	5.34
MASSACHUSETTS.								
Sandwich	Barnstable	N. Barrows, M. D	1	90	19	56	71.2	7.18
Topsfield	Essex	A. M. Merriam	1	96	3, 31	59	68.9	3.50
Newbury	....do	John H. Caldwell	1	98	31	56	72.2	......
New Bedford	Bristol	Samuel Rodman	9, 10, 14	84	31	56	68.9	7.62
Worcester	Worcester	....	1	91	15	56	71.7	3.11
Baldwinsville	....do	Rev. E. Dewhurst	1	93	31	53	65.8	5.56
Mendon	....do	Jno. G. Metcalf, M.D.	1	93	3, 20, 29, 31	58	71.8	3.00
Amherst	Hampshire	Prof. E. S. Snell	1	98	31	55	70.8	4.40
Westfield	Hampden	Rev. E. Davis	1	95	19, 29	56	70.1	3.19
Springfield	....do	J. Weatherhead	1	102	31	50	61.3	2.54
Richmond	Berkshire	William Bacon	1	98	4	56	73.6	6.88
Williamstown	....do	Prof. A. Hopkins	1	96	31	52	69.3	4.96
CONNECTICUT.								
Pomfret	Windham	Rev. D. Hunt	1	90	31	54	69.6	3.45
Columbia	Tolland	Wm. H. Yeomans	1	96	31	56	74.3	......
Middletown	Middlesex	Prof. Jno. Johnston	1	100	31	57	73.8	2.92
Colebrook	Litchfield	Charlotte Rockwell	1	95	31	55	70.3	......
NEW YORK.								
Moriches	Suffolk	Mrs. and Miss Smith	11	98	30, 31	62	77.2	3.04
Argyle	Washington	George M. Hunt	1	93	29	57	74.8	6.69
South Hartford	....do	G. M. Ingalsbe	1	96	19	56	73.9	7.68
Fishkill Landing	Dutchess	Wm. H. Denning	1	94	31	58	74.0	9.56
Garrison's	Putnam	Thomas B. Arden	1	87	31	58	72.0	8.24
Throg's Neck	Westchester	F. M. Rogers	11	94	31	62	75.9	3.72
Deaf and Dumb Inst.	New York	Prof. O. W. Morris	1	96	3, 21, 31	67	79.4	5.19
St. Xavier's College	....do	Rev. Jno. M. Aubier	1	95	31	62	76.5	1.66
Flatbush	Kings	Eli T. Mack	11	95	30	61	74.7	2.82
Troy	Rensselaer	Jno. W. Heimstreet	1	97	31	59	72.7	4.97
Schenectady	Schenectady	Harmon V. Swart	1	96	31	58	72.3	......
Gouverneur	St. Lawrence	C. H. Russell	1	93	30, 31	54	68.6	2.65
Clinton	Oneida	H. M. Paine, M. D	1	101	31	55	73.5	7.56
South Trenton	....do	Storrs Barrows	......	......	......	......	......	7.95
Oneida	Madison	Dr. S. Spooner	1	98	30, 31	52	71.3	12.53
Theresa	Jefferson	S. O. Gregory	1	92	31	49	69.7	3.49
Oswego	Oswego	Wm. S. Malcolm	1	90	31	50	69.9	6.66
Palermo	....do	E. B. Bartlett	1	97	31	48	69.3	......
Baldwinsville	Onondaga	John Bowman	1	88	31	51	68.3	......
Skaneateles	....do	W. M. Beauchamp	1	91	31	51	68.6	......
Auburn	Cayuga	John B. Dill	13	94	31	56	74.9	......
Nichols	Tioga	Robert Howell	1	99	31	50	70.9	......
Palmyra	Wayne	Stephen Hyde	1	91	30, 31	52	71.0	......
Geneva	Ontario	Rev. W. D. Wilson	13	92	30, 31	52	71.2	7.14
Rochester	Monroe	M. M. Mathews, M.D	13	93	30, 31	51	71.4	5.49
Do	....do	Prof. C. Dewey	1	92	31	48	70.9	5.49
Wilson	Niagara	E. S. Holmes, D. D. S	9, 10	97	31	53	73.0	......
Buffalo	Erie	Wm. Ives	6	90	31	46	70.3	7.57
Jamestown	Chautauqua	Rev. W. S. Roe, M.D.	11	94	31	47	69.9	9.50

I. AUGUST, 1864—CURRENT WEATHER—Continued.

Place.	County.	Observer.	Date.	Maximum temp.	Date.	Minimum temp.	Mean temp.	Rain.
NEW JERSEY.				°		°	°	*In.*
Newark	Essex	W. A. Whitehead	1, 11	92	31	58	74.6	3.21
Burlington	Burlington	John C. Deacon	11	94	29, 30, 31	60	74.9	2.75
Progress	...do	Thomas J. Beans	11	95	30, 31	61	76.1	3.03
Mount Holly	...do	M. J. Rhees, M. D	11	92	29, 30, 31	60	76.1	......
Haddonfield	Camden	J. S. Lippincott	1, 11	91	31	58	75.4	2.53
Greenwich	Cumberland	Clarkson Sheppard	1, 11	88	31	55	72.6	1.52
PENNSYLVANIA.								
Nazareth	Northampton	L. E. Ricksecker	11	98	31	59	76.2	......
Philadelphia	Philadelphia	Pf J. A. Kirkpatrick	11	95	31	63	79.3	1.54
Germantown	...do	Thomas Meehan	11	100	31	56	......	......
Fallsington	Bucks	Ebenezer Hance	11	93	29	60	75.0	1.70
Moorland	Montgomery	Anna Spencer	11	94	31	57	74.2	2.93
Silver Spring	Lancaster	H. G. Bruckhart	11	96	30, 31	54	74.0	......
Berwick	Columbia	John Eggert	11, 13	92	30, 31	58	73.5	7.06
Harrisburg	Dauphin	John Heisely, M.D.	11	93	30	62	77.3	4.92
Tioga	Tioga	E. T. Bentley	11	97	31	50	72.1	5.42
Fleming	Centre	Samuel Brugger	10	94	31	55	72.1	6.24
Pennsville	Clearfield	Elisha Fenton	1, 11	93	31	52	69.8	5.69
Blairsville	Indiana	W. R. Boyers	16	97	29, 30	64	75.0	7.80
Connellsville	Fayette	John Taylor	11	92	31	47	72.5	......
Canonsburg	Washington	Rev. Wm. Smith, D.D	11	91	31	50	70.7	4.68
DELAWARE.								
Wilmington	New Castle	Dr. Urban D. Hedges	2, 11, 12, 14	95	31	56	79.6	3.30
MARYLAND.								
Annapolis	Anne Arundel	Wm. R. Goodman	11	93	31	61	78.8	2.77
St. Inigoes	St. Mary's	Rev. J. Stephenson	13	94	31	66	80.4	5.05
Sykesville	Carroll	Miss H. M. Baer	10, 12	90	31	59	75.8	3.00
DIST. OF COLUMBIA.								
Washington	Washington	Smithsonian Instit'n.	1	95	31	61	78.2	4.94
SOUTH CAROLINA.								
Hilton Head	Beaufort	Lieut. C. R. Suter	3	98	21	76	84.1	3.66
KENTUCKY.								
Louisville	Jefferson	Mrs. L. Young	10	92	31	50	75.9	5.63
OHIO.								
Saybrook	Ashtabula	James B. Fraser	11	90	31	52	71.2	5.85
Austinburg	...do	E. D. Winchester	12	92	30, 31	52	71.8	5.44
East Fairfield	Columbiana	S. B. McMillan	11	91	31	55	71.2	5.35
New Lisbon	...do	J. F. Benner	10	98	31	52	71.6	4.74
Welshfield	Geauga	B. F. Abell, A. M	10, 11, 12	90	31	51	71.5	8.23
Milnersville	Guernsey	Rev. D. Thompson	6, 10, 12	95	30	51	......	7.39
Cleveland	Cuyahoga	Mr. & Mrs G. A. Hyde	1, 13	90	31	55	73.2	6.71
Wooster	Wayne	Martin Winger	10, 11	95	30	54	73.5	......
Gallipolis	Gallia	A. P. Rogers	1, 10, 11, 12	92	31	52	72.7	4.39
Kelley's Island	Erie	Geo. C. Huntington	11	91	31	58	75.0	3.20
Norwalk	Huron	Rev. A. Newton	10, 12	90	31	50	70.5	4.98
Kingston	Ross	Prof. Jno. Haywood	10	96	30, 31	56	75.2	2.29
Portsmouth	Scioto	L. Engelbrecht	11, 12	89	31	55	75.3	3.55
Urbana	Champaign	Prof. M. G. Williams	11	95	31	50	72.6	5.47
Hillsborough	Highland	J. McD. Mathews	10	92	31	53	73.7	3.70
Ripley	Brown	Dr. G. Bambach	9	102	31	58	76.9	3.58
Bethel	Clermont	George W. Crane	6, 7, 10	95	31	50	74.1	4.25
Cincinnati	Hamilton	G. W. Harper	7	97	30, 31	57	76.0	3.42
College Hill	...do	John W. Hammitt	12	96	30, 31	62	78.1	6.88
Do	...do	I. H. Wilson	8, 10, 13	88	30	59	74.6	4.35
MICHIGAN.								
Ypsilanti	Washtenaw	C. S. Woodard	8, 11	92	31	51	73.8	2.26
Agricultural College.	Ingham	Prof. R. C. Kedzie	11	99	30	46	70.7	0.40
Garlick	Ontonagon	Edwin Ellis	10, 11	92	29	52	68.7	......

I. AUGUST, 1864—CURRENT WEATHER—Continued.

Place.	County.	Observer.	Date.	Maximum temp.	Date.	Minimum temp.	Mean temp.	Rain.
INDIANA.				°		°	°	In.
Pennville	Jay	Miriam Griest	10	104	31	49	76.7	......
Muncie	Delaware	E. J. Rice	15	97	30, 31	52	....	4.75
Spiceland	Henry	William Dawson	9	97	30	53	73.3	3.40
New Castle	....do	Thos. B. Redding	9	99	31	50	73.0	4.16
Madison	Jefferson	Rev. Samuel Collins	9, 15	91	31	60	78.0	10.00
New Albany	Floyd	Dr. E. S. Crozier	10	92	31	55	73.4	4.87
South Bend	St. Joseph	Reuben Borroughs	9, 10	98	18, 30	54	71.2	0.94
Indianapolis	Marion	Royal Mayhew	12	95	31	53	73.9	2.40
Bloomingdale	Park	Wm. H. Hobbs	8	98	28	50	74.3	......
New Harmony	Posey	John Chappellsmith	9	92	19	61	75.8	5.11
ILLINOIS.								
Evanston	Cook	Homer W. Scovill	12	86	21, 22	58	72.5	0.83
Chicago	....do	Samuel Brooks	11	93	31	54	72.5	......
Riley	McHenry	E. Babcock	10	95	18	52	69.6	1.32
Sandwich	DeKalb	Dr. N. E. Ballou	9, 10	95	22, 29, 30	54	71.4	1.08
Ottawa	La Salle	Mrs. E. H. Merwin	10	102	29	54	72.1	1.85
Winnebago	Winnebago	James W. Tolman	10, 11	95	18, 19	54	70.7	1.88
Tiskilwa	Bureau	Verry Aldrich	14	94	19	52	72.3	......
Wyanet	....do	E. S. Phelps, jr	8	97	18	47	73.8	1.75
Peoria	Peoria	Frederick Brendel	8	97	21	55	75.2	1.56
Pekin	Tazewell	J. H. Riblett	8	93	31	58	74.6	2.46
Monroe City	Monroe	Miss F. E. Whelpley	12	92	31	51	71.2	3.35
Hoyleston	Washington	J. Ellsworth	9	100	21	58	77.0	2.13
Waverly	Morgan	Timothy Dudley	2	94	17, 18, 19, 21	61	75.1	1.55
Mount Pleasant	Henry	Rev. E. L. Briggs	24	94	29	58	73.7	1.85
Galesburg	Knox	Pf. Wm. Livingston	8, 10	90	31	53	72.4	2.22
Vermont	Fulton	Patterson Hamer	10	95	31	54	76.5	0.59
Manchester	Scott	Dr. J. & Miss Grant	15, 24	92	20	58	75.2	1.88
Augusta	Hancock	S. B. Mead, M. D	24	92	21	55	73.1	1.29
WISCONSIN.								
Manitowoc	Manitowoc	Jacob Lüps	8, 9, 10	88	30, 31	48	68.5	3.16
Milwaukee	Milwaukee	Carl Winkler	12, 13	89	30, 31	55	70.1	0.73
Do	....do	I. A. Lapham, LL. D	9	92	31	49	69.8	0.61
Green Bay	Brown	Friedrich Deckner	8	92	31	47	69.6	2.36
Geneva	Walworth	Wm. H. Whiting	9, 10, 11	90	19	50	69.6	......
Waupacca	Waupacca	H. C. Mead	10	98	30, 31	52	73.8	......
Embarrass	....do	E. Everett Breed	8, 11	98	31	40	72.5	3.41
Beloit	Rock	William Porter	10	96	30	50	70.9	1.77
MINNESOTA.								
Beaver Bay	Lake	C. Wieland	8	88	29, 31	52	66.2	2.28
St. Paul	Ramsey	Rev. A. B. Paterson	9	93	17, 29	53	71.3	2.00
Mankota	Blue Earth	William Kilgore	14	95	17, 18	50	....	......
New Ulm	Brown	Charles Roos	9, 10	97	17	54	74.5	2.00
IOWA.								
Lyons	Clinton	P. J. Farnsworth, M. D	10	94	31	56	72.2	8.10
Dubuque	Dubuque	Asa Horr, M. D	10	95	20	52	72.4	1.35
Guttenburg	Clayton	P. Dorweiler	9, 10	88	20, 30	58	71.5	3.00
Monticello	Jones	Chauncey Mead	10	95	20	53	71.0	2.37
Independence	Buchanan	D. S. Deering	9, 10	95	19	55	71.0	......
Do	...do	A. C. Wheaton	10	98	17, 20	52	72.3	3.50
Iowa City	Johnson	Theo. S. Parvin, A. M.	8	91	20	50	73.0	7.60
Fort Madison	Lee	Daniel McCready	15	97	19, 20	52	74.2	2.37
Waterloo	Black Hawk	T. Steed	8, 9	90	19, 25	54	73.0	......
Iowa Falls	Hardin	N. Townsend	9	91	19, 29	50	70.4	2.60
Algona	Kossuth	Dr. & Miss L. McCoy.	10	96	18	50	71.7	1.50
Onawa	Monona	Dr. Richard Stebbins	8, 9, 24	92	18	54	72.4	......
MISSOURI.								
Allenton	St. Louis	Aug. Fendler	26	99	22	55	74.1	1.66
Canton	Lewis	George P. Ray	12	95	19, 20	56	74.1	3.24
Harrisonville	Cass	John Christian	1	100	28	64	....	4.44
KANSAS.								
Manhattan	Riley	H. L. Denison	1	99	19	56	78.3	1.84
Fort Riley	Davis	Elford E. Lee	31	107	17	65	82.1	2.44

I. AUGUST, 1864—CURRENT WEATHER—Continued.

Place.	County.	Observer.	Date.	Maximum temp.	Date.	Minimum temp.	Mean temp.	Rain.
NEBRASKA.				°		°	°	In.
Elkhorn City	Washington	Miss A. M. J. Bowen	24	99	17, 18	57	74.0	......
Bellevue	Sarpy	Rev. Wm. Hamilton	24	91	18	58	75.2	1.48
OREGON.								
Auburn	Baker	S. M. W. Hindman	17	95	12	50	72.5	6.41
UTAH TERRITORY.								
Great Salt Lake City	Great Salt Lake	W. W. Phelps	5	95	13	62	77.9	12.50
CALIFORNIA.								
Sacramento	Sacramento	T. M. Logan, M. D.	28	94	31	62	74.7	0.89
Meadow Valley	Plumas	Mrs. M. D. Smith	12	97	30	49	65.7	2.40

II. AUGUST—AVERAGES.

States and Territories.	Av. number of places.	Averages, 1854.		Averages, 1855.		Averages, 1856.		Averages, 1857.		Averages, 1858.		Averages, 1859.		Averages for six years.		Averages, 1863.		Averages, 1864.	
		Mean temp.	Mean rain.	Mean temp.	Mean rain.	Mean temp.	Mean rain.	Mean temp.	Mean rain.	Mean temp.	Mean rain.	Mean temp.	Mean rain.	Mean temp.	Mean rain.	Mean temp.	Mean rain.	Mean temp.	Mean rain.
		Deg.	*In.*	*Deg.*	*In.*	*Deg.*	*In.*	*Deg.*	*In.*	*Deg.*	*In.*	*Deg.*	*In.*	*Deg.*	*In.*	*Deg.*	*In.*	*Deg.*	*In.*
Maine	6	62.7	0.51	62.4	3.9	63.8	8.2	64.2	5.6	63.6	4.6	66.9	2.5	64.0	4.17	66.8	3.3	68.8	5.12
New Hampshire	4	68.6	0.48	64.3	2.5	65.9	......	66.6	5.9	65.1	4.1	58.7	3.4	65.0	3.42	66.4	4.8	68.9	5.85
Vermont	4	68.0	0.76	62.4	2.9	64.8	8.4	64.9	5.9	65.5	3.6	66.5	2.4	65.3	4.04	67.6	4.6	67.2	4.85
Massachusetts	12	68.3	1.17	66.1	3.2	65.5	11.1	67.4	5.1	66.0	5.1	66.8	4.6	66.7	5.03	69.8	4.6	69.6	4.72
Rhode Island	1	68.6	0.30	67.9	2.0	69.8	5.6	66.8	4.8	66.4	8.2	69.2	3.7	68.1	4.13	70.3	4.6	......	......
Connecticut	4	68.1	0.71	67.4	2.0	67.6	10.7	68.6	5.0	66.5	4.4	67.3	7.0	67.6	4.95	70.3	5.6	72.0	3.19
New York	18	71.2	1.29	67.9	2.4	66.1	4.8	61.0	4.7	69.4	3.5	68.8	3.8	67.5	3.38	69.6	5.4	72.4	6.15
New Jersey	4	72.8	1.04	70.7	2.9	70.3	4.8	72.3	6.6	70.4	3.7	70.0	4.6	71.1	3.92	76.6	4.1	75.0	2.61
Pennsylvania	20	74.9	1.47	71.4	3.8	69.6	4.1	69.6	4.8	71.5	3.4	71.2	4.1	71.3	3.58	73.6	2.6	74.0	4.80
Delaware	1	......	......	......	......	......	......	74.8	6.4	77.3	4.3	......	5.5	76.0	5.40	......	......	79.6	3.30
Maryland	5	76.4	1.12	72.6	5.7	70.1	5.1	72.5	5.9	73.2	2.6	73.2	2.7	73.1	3.85	78.5	0.51	78.3	3.61
District of Columbia	1	......	......	74.9	2.9	72.6	4.2	73.5	10.2	74.7	4.8	74.2	3.2	74.0	5.10	78.2	0.86	78.2	4.94
South Carolina	5	79.0	4.34	80.7	4.4	78.6	7.7	79.3	4.9	80.3	4.8	75.9	9.5	79.0	5.97	......	......	84.1	3.66
Tennessee	2	80.2	2.53	76.4	4.6	73.0	4.0	73.2	5.1	76.3	2.5	75.3	4.6	75.7	3.92	......	......	......	......
Kentucky	4	80.6	1.56	75.4	4.4	72.6	3.5	73.3	3.2	75.6	2.3	72.6	6.4	75.0	3.59	......	......	75.9	5.63
Ohio	18	76.4	1.83	72.2	4.1	68.3	1.9	69.9	3.6	71.5	4.4	71.3	3.9	71.6	3.31	72.8	2.7	73.6	4.94
Michigan	8	72.9	1.13	68.5	2.3	65.0	1.4	66.7	4.5	69.2	4.0	69.0	2.6	68.6	2.69	70.3	5.6	71.1	1.33
Indiana	4	77.3	3.01	74.0	4.4	71.3	2.9	72.9	4.3	73.7	4.0	73.6	4.3	73.8	3.84	73.6	2.6	74.4	4.45
Illinois	13	78.0	1.83	71.7	4.1	70.4	2.8	72.7	4.5	72.5	3.0	72.2	2.5	72.9	3.14	72.9	2.4	73.3	1.72
Wisconsin	9	73.4	2.16	67.7	1.8	66.9	1.9	67.4	3.6	68.9	3.6	69.5	1.8	69.0	2.44	69.3	3.1	70.6	2.01
Minnesota	3	70.4	2.15	63.4	10.5	63.4	2.7	67.8	3.9	68.6	3.9	66.2	4.1	66.7	4.53	67.0	3.2	70.7	2.09
Iowa	8	74.5	2.21	68.6	3.3	67.8	1.6	71.0	5.8	71.9	3.3	72.5	1.8	71.1	3.04	74.9	5.2	72.1	3.60
Missouri	2	82.8	1.82	74.4	6.5	74.0	4.4	73.4	3.5	78.7	2.9	76.1	2.9	76.6	3.64	77.7	3.3	74.1	3.11
Kansas	4	......	......	......	......	......	......	75.8	3.9	75.9	4.0	75.9	5.6	75.9	4.50	77.8	4.7	80.2	2.14
Nebraska Territory	2	......	......	......	......	......	......	......	10.1	73.6	1.9	73.8	1.8	73.7	4.40	72.5	2.7	74.6	1.48
California	2	68.1	0.00	......	0.0	69.6	0.0	61.7	0.0	69.2	0.1	71.3	0.0	68.0	0.00	......	......	70.2	1.65

I. SEPTEMBER, 1864—CURRENT WEATHER.

Place.	County.	Observer.	Date.	Maximum temp.	Date.	Minimum temp.	Mean temp.	Rain.
MAINE.				°		°	°	In.
Steuben	Washington	J. D. Parker	28	72	18, 22	38	53.6	4.10
West Waterville	Kennebec	B. F. Wilbur	1	76	22	40	56.1	3.25
Lisbon	Androscoggin	Asa P. Moore	1, 2	77	26	35	55.3	6.08
Cornish	York	Silas West	1	71	26	35	52.2	3.70
Cornishville	....do	G. W. Guptill	1, 2	72	26	39	56.5	3.97
NEW HAMPSHIRE.								
Shelburne	Coos	Fletcher Odell	1	79	27	33	55.1	......
Stratford	....do	Branch Brown	2	72	22, 26	32	51.3	5.11
Barnstead	Belknap	Chas. H. Pitman	2	79	26	40	58.4	3.38
Claremont	Sullivan	Arthur Chase	27	78	17, 26	40	58.0	3.10
Do	....do	Stephen O. Mead	26	80	25, 26	42	58.1	......
VERMONT.								
Lunenburg	Essex	H. A. Cutting	9	78	18, 26	32	55.6	2.75
Craftsbury	Orleans	Jas. A. Paddock	27	73	26	34	51.6	4.80
Calais	Washington	Jas. K. Tobey	27	72	26	35	51.6	......
Burlington	Chittenden	Rev. McK. Petty	27	69	26	38	54.0	5.49
Middlebury	Addison	H. A. Sheldon	3, 18	70	26	42	56.0	8.32
MASSACHUSETTS.								
Sandwich	Barnstable	Eugene Tappan	3	84	26	44	61.7	2.32
Newbury	Essex	John H. Caldwell	24	77	26	39	57.5	......
Topsfield	....do	A. M. Merriam	27	82	8	42	59.6	2.40
New Bedford	Bristol	Samuel Rodman	2	72	26	40	57.5	2.19
Worcester	Worcester	F. H. Reed	28	82	27	43	59.3	2.93
Mendon	....do	Jno. G. Metcalf, M.D.	28	79	26	40	58.8	2.45
Amherst	Hampshire	Prof. E. S. Snell	2	75	26	41	57.8	2.91
Springfield	Hampden	J. Weatherhead	2, 27	88	26	36	59.2	2.61
Westfield	....do	Rev. E. Davis	2, 3	77	8	40	57.8	2.86
Richmond	Berkshire	Wm. Bacon	1, 22	78	26	36	....	6.38
Williams College	....do	Prof. A. Hopkins	27	77	26	41	56.6	3.06
CONNECTICUT.								
Pomfret	Windham	Rev. D. Hunt	27	76	26	40	57.7	3.07
Columbia	Tolland	Wm. H. Yeomans	3	80	8, 9	38	61.3	......
Middletown	Middlesex	Prof. Jno. Johnston	3	84	8	42	61.3	3.45
Colebrook	Litchfield	Charlotte Rockwell	2	76	26	39	57.9	......
NEW YORK.								
South Hartford	Washington	G. M. Ingalsbe	27	79	26	44	60.9	4.55
Fishkill Landing	Dutchess	Wm. H. Denning	2, 3	77	31	43	60.6	3.62
Garrison's	Putnam	Thomas B. Arden	2	72	1, 26	47	61.0	3.40
Throg's Neck	Westchester	F. M. Rogers	27	78	26	48	63.2	4.90
Deaf and Dumb Inst.	New York	Prof. O. W. Morris	2, 24, 27	80	17	55	65.7	5.45
St. Xavier's College	....do	Rev. Jno. M. Aubier	27	79	26	50	63.5	5.14
Flatbush	Kings	Eli T. Mack	27	78	26	46	61.1	4.34
Schenectady	Schenectady	Harmon V. Swart	27	80	26	41	57.3	......
Gouverneur	St. Lawrence	C. H. Russell	23	76	30	34	59.4	5.65
Clinton	Oneida	H. M. Paine, M. D	3, 27	82	26	45	62.0	2.72
South Trenton	....do	Storrs Barrows	....	......	....	......	....	3.64
Theresa	Jefferson	S. O. Gregory	3	80	26	35	56.5	4.30
Oswego	Oswego	Wm. S. Malcolm	23	77	26	41	58.9	1.85
Palermo	....do	E. B. Bartlett	23	81	26	36	57.7	2.70
Baldwinsville	Onondaga	John Bowman	3, 23	72	26	42	57.0	......
Skaneateles	....do	W. M. Beauchamp	27	76	26	40	57.0	......
Auburn	Cayuga	John B. Dill	23	82	26	45	63.7	......
Palmyra	Wayne	Stephen Hyde	23	80	26	47	61.0	......
Nichols	Tioga	Robert Howell	27	88	17, 21, 30	44	59.0	......
Rochester	Monroe	Prof. C. Dewey	23	80	17	42	59.3	1.83
Jamestown	Chautauqua	Rev. S. W. Roe, M. D.	7	86	30	44	59.3	3.80
NEW JERSEY.								
Newark	Essex	W. A. Whitehead	2, 27	77	26	44	62.2	4.68
Mount Holly	Burlington	M. J. Rhees, M. D	24	78	26	47	63.8	......
Progress	....do	Thomas J. Beans	2	80	12, 26, 30	52	63.1	6.28
Haddonfield	Camden	J. S. Lippincott	24	79	25, 26	50	63.4	6.55
Greenwich	Cumberland	C. Sheppard	24	75	26	47	60.6	4.28

I. SEPTEMBER, 1864—CURRENT WEATHER—Continued.

Place.	County.	Observer.	Date.	Maximum temp.	Date.	Minimum temp.	Mean temp.	Rain.
PENNSYLVANIA.				°		°	°	In.
North Whitehall	Lehigh	Edward Kohler	24	78	20	42	61.0	......
Nazareth	Northampton	L. Ricksecker	2	82	30	45	62.5	......
Fallsington	Bucks	Ebenezer Hance	2, 22, 24	78	26	51	63.7	4.10
Philadelphia	Philadelphia	Pf. J. A. Kirkpatrick.	24	81	26	53	66.8	7.32
Germantown	....do	Thomas Meehan	2	86	8, 12	50	......	......
Moorland	Montgomery	Anna Spencer	2	78	26	48	62.0	5.66
Harrisburg	Dauphin	Jno. Heisely, M. D	10, 24	79	20	53	65.2	12.36
Fleming	Centre	Samuel Brugger	9, 10, 17, 20	78	20	42	60.8	6.66
Pennsville	Clearfield	Elisha Fenton	22	80	20	40	57.7	4.32
Blairsville	Indiana	W. R. Boyers	1, 2, 4, 5, 26	72	14, 22, 24	48	60.0	16.91
Connellsville	Fayette	John Taylor	2, 5, 23	78	12	44	61.6	......
Canonsburg	Washington	Rev. W. Smith, D. D.	2	75	1, 25	44	59.8	8.55
DELAWARE.								
Wilmington	New Castle	U. D. Hedges, M. D	3, 24, 29	80	25	51	66.7	8.80
MARYLAND.								
Annapolis	Anne Arundel	Wm. R. Goodman	24	82	26	50	67.2	3.65
St. Inigoes	St. Mary's	Rev. J. Stephenson	5, 24	82	26	54	70.1	2.85
Sykesville	Carroll	Miss H. M. Baer	24	80	8, 20, 25	52	64.0	3.50
DIST. OF COLUMBIA.								
Washington	Washington	Smithsonian Instit'n.	24	81	20, 26	52	66.0	2.57
SOUTH CAROLINA.								
Hilton Head	Beaufort	Lieut. C. R. Suter	3	98	21	76	86.8	2.86
TENNESSEE.								
Clarksville	Montgomery	William M. Stewart	3	90	25	47	68.9	2.06
KENTUCKY.								
Louisville	Jefferson	Mrs. L. Young	4, 23	84	19	39	67.8	4.33
OHIO.								
Austinburg	Ashtabula	E. D. Winchester	22, 23	78	13, 28	44	58.0	5.85
Saybrook	....do	James B. Fraser	22	77	28	46	60.8	4.55
New Lisbon	Columbiana	J. F. Benner	14, 23	80	20, 26	42	60.5	5.97
Welshfield	Geauga	B. F. Abell, A. M	9, 10	76	24, 25	46	60.5	7.54
Cleveland	Cuyahoga	Mr. & Mrs. G. A. Hyde	23	80	25, 30	50	63.1	5.19
Wooster	Wayne	Martin Winger	10	81	13	44	63.0	......
Gallipolis	Gallia	A. P. Rogers	2, 5	82	13	44	65.7	3.46
Kelley's Island	Erie	Geo. C. Huntington.	10, 23	80	25	50	64.4	4.89
Norwalk	Huron	Rev. A. Newton	23	83	25	44	61.2	5.11
Westerville	Franklin	Pf. H. A. Thompson.	10, 23	80	20	48	63.0	2.83
Kingston	Ross	Pf. John Haywood	2	87	13, 24	50	65.5	3.49
Portsmouth	Scioto	L. Engelbrecht	14	81	13	48	66.5	4.70
Urbana	Champaign	Prof. M. G. Williams.	2, 13, 10	80	25	42	63.1	3.71
Hillsboro'	Highland	J. McD. Mathews	2	84	25	44	64.5	3.32
Ripley	Brown	Dr. G. Bambach	23	86	20	45	67.4	6.55
Bethel	Clermont	George W. Crane	2	84	24	42	63.2	7.66
Eaton	Preble	Miss Ollitippa Larsh.	23	81	25	47	63.0	10.00
College Hill	Hamilton	I. H. Wilson	3	84	25	50	65.9	2.50
Do	....do	John W. Hammitt	2	84	26	50	62.5	......
Cincinnati	....do	George W. Harper	2	88	19	44	65.7	8.63
MICHIGAN.								
Pontiac	Oakland	James A. Weeks	23	79	12, 25	40	57.6	......
Monroe City	Monroe	Miss F. E. Whelpley.	10	83	25	45	60.8	3.28
Agricultural College	Ingham	Prof. R. C. Kedzie	9	79	25	41	59.6	3.40
INDIANA.								
Spiceland	Henry	William Dawson	2	84	25	42	63.8	4.90
New Castle	....do	T. B. Redding, A. M	3, 23	86	19	40	63.1	5.89
Madison	Jefferson	Rev. S. Collins	23	83	19	49	....	5.75

I. SEPTEMBER, 1864—CURRENT WEATHER—Continued.

Place.	County.	Observer.	Date.	Maximum temp.	Date.	Minimum temp.	Mean temp.	Rain.
INDIANA—Cont'd.				°		°	°	In.
New Albany	Floyd	Dr. E. S. Crozier	5	85	25	45	68. 8	1. 64
South Bend	St. Joseph	Reuben Burroughs	22	85	30	38	60. 9	4. 33
Indianapolis	Marion	R. Mayhew	3, 10	84	19, 25	41	64. 3	3. 19
Rensselaer	Jasper	Dr. J. H. Loughridge	2, 3	87	19	34	64. 7	5. 55
New Harmony	Posey	John Chappellsmith	4	91	25	46	69. 4	2. 65
ILLINOIS.								
Chicago	Cook	Samuel Brookes	1	85	24	37	59. 0	......
Ottawa	La Salle	Mrs. E. H. Merwin	9	94	24	36	63. 8	2. 58
Winnebago	Winnebago	James W. Tolman	9	86	24	39	61. 8	3. 57
Wyanet	Bureau	E. S. & Miss L. Phelps	3	98	28	36	65. 7	3. 38
Tiskilwa	....do	Verry Aldrich	3	92	24, 25, 28	40	64. 5	......
Hennepin	Putnam	Smiley Shepherd	10	95	31	48	74. 7	......
Peoria	Peoria	Frederick Brendel	3	98	19, 24	43	67. 3	4. 81
Elmore	....do	W. H. Adams	......	......	......	......	......	3. 50
Pekin	Tazewell	J. H. Riblett	3	96	24	44	66. 7	4. 65
Hoylton	Washington	J. Ellsworth	2, 3	104	19	43	69. 5	2. 00
Waverly	Morgan	Timothy Dudley	3	98	24	44	68. 2	3. 65
Galesburg	Knox	Prof. Wm. Livingston	3	92	24	38	63. 6	2. 16
Augusta	Hancock	S. B. Mead, M. D	3	100	28, 30	45	66. 9	4. 16
WISCONSIN.								
Manitowoc	Manitowoc	Jacob Lüps	10	72	30	34	58. 1	3. 29
Milwaukee	Milwaukee	I. A. Lapham, LL. D.	9	84	25	40	61. 0	2. 93
Green Bay	Brown	Frederick Deckner	17	77	24, 28, 29	36	58. 3	7. 74
Geneva	Walworth	William H. Whiting	9	78	24	40	60. 3	......
Delavan	....do	Levens Eddy	9	82	24	37	60. 1	3. 74
Embarrass	Waupacca	Edward E. Breed	26	80	28	27	58. 0	4. 36
Waupacca	....do	H. C. Mead	2	82	24, 28, 29, 30	42	......	......
Beloit	Rock	William Porter	9	84	24	41	61. 8	3. 90
MINNESOTA.								
Beaver Bay	Lake	C. Wieland	8	70	30	32	52. 5	2. 32
St. Paul	Ramsey	Rev. A. B. Paterson	9	93	17, 29	53	71. 3	2. 00
New Ulm	Brown	Charles Roos	9	93	28	32	62. 7	0. 48
IOWA.								
Lyons	Clinton	Dr. P. J. Farnsworth	13	86	24	40	64. 7	2. 60
Dubuque	Dubuque	Asa Horr, M. D	9	89	24	39	63. 4	2. 29
Guttenburg	Clayton	Philip Dorweiler	9	84	24	42	63. 3	6. 80
Monticello	Jones	Chauncey Mead	13	90	28	34	60. 1	1. 17
Independence	Buchanan	A. C. Wheaton	9	89	29	34	65. 2	4. 00
Do	....do	D. S. Deering	13	87	24	37	62. 4	......
Iowa City	Johnson	Theo. S. Parvin, A. M.	13	92	24	36	66. 9	2. 12
Fort Madison	Lee	Daniel McCready	3	97	24	37	66. 7	2. 57
Waterloo	Black Hawk	T. Steed	13	88	28, 29	40	63. 2	1. 88
Iowa Falls	Hardin	N. Townsend	9, 21	86	19, 24	40	64. 3	2. 14
Algona	Kossuth	Dr. and Miss McCoy	9	89	24	32	60. 9	2. 31
MISSOURI.								
Allenton	St. Louis	A. Fendler	2	107	19, 25	37	67. 9	3. 37
Canton	Lewis	George P. Ray	3	103	19	38	68. 1	5. 24
Easton	Buchanan	P. B. Sibley	1	104	29	36	68. 9	3. 62
KANSAS.								
Manhattan	Riley	H. L. Denison	1, 3	104	24	42	70. 9	2. 30
Fort Riley	Davis	H. A. Sturges	1, 2	106	30	52	75. 7	2. 15
NEBRASKA TERR.								
Elkhorn City	Washington	Miss A. M. J. Bowen	2	99	24	32	66. 4	......
Bellevue	Sarpy	Rev. Wm. Hamilton	2	99	24, 30	40	67. 4	1. 77
UTAH TERRITORY.								
Great Salt Lake City	Great Salt Lake	W. W. Phelps	10	87	28	45	65. 9	7. 43

II. SEPTEMBER—AVERAGES.

States and Territories.	Av. number of places.	Averages, 1854.		Averages, 1855.		Averages, 1856.		Averages, 1857.		Averages, 1858.		Averages, 1859.		Averages for six years.		Averages, 1863.		Averages, 1864.	
		Mean temp.	Mean rain.	Mean temp.	Mean rain.	Mean temp.	Mean rain.	Mean temp.	Mean rain.	Mean temp.	Mean rain.	Mean temp.	Mean rain.	Mean temp.	Mean rain.	Mean temp.	Mean rain.	Mean temp.	Mean rain.
		Deg.	*In.*	*Deg.*	*In.*	*Deg.*	*In.*	*Deg.*	*In.*	*Deg.*	*In.*	*Deg.*	*In.*	*Deg.*	*In.*	*Deg.*	*In.*	*Deg.*	*In.*
Maine	6	55. 3	4. 50	56. 4	1. 8	58. 8	3. 5	57. 8	1. 6	58. 8	3. 5	55. 9	4. 0	57. 2	3. 17	55. 9	3. 68	54. 7	4. 22
New Hampshire	4	59. 9	5. 63	59. 2	0. 3	60. 1	4. 9	58. 7	1. 3	58. 1	5. 0	48. 2	4. 2	57. 4	3. 52	54. 9	2. 34	56. 2	3. 86
Vermont	4	58. 4	4. 09	58. 1	4. 5	58. 3	4. 0	57. 8	1. 8	59. 0	3. 8	56. 0	4. 2	57. 1	3. 77	56. 3	3. 42	53. 8	5. 34
Massachusetts	12	61. 3	5. 56	61. 1	1. 0	61. 4	4. 8	60. 8	2. 9	61. 1	3. 8	58. 4	4. 0	62. 1	3. 68	58. 5	3. 38	58. 6	3. 01
Rhode Island	1	61. 4	6. 10	61. 9	0. 3	62. 2	5. 1	60. 3	2. 3	62. 2	3. 1	59. 6	3. 7	61. 5	3. 43	57. 8	1. 74	......	......
Connecticut	4	61. 6	5. 36	62. 4	0. 5	63. 4	4. 1	61. 5	3. 0	61. 4	4. 9	59. 1	4. 0	61. 6	3. 64	58. 1	2. 31	59. 6	3. 26
New York	18	63. 7	5. 10	62. 2	1. 9	61. 9	3. 7	61. 2	2. 8	54. 2	3. 7	59. 3	4. 2	60. 5	3. 60	56. 9	2. 31	60. 2	3. 86
New Jersey	4	67. 4	2. 92	65. 4	2. 9	65. 1	2. 8	65. 3	2. 7	63. 6	1. 5	62. 1	7. 3	64. 8	3. 40	60. 0	1. 30	62. 6	5. 45
Pennsylvania	20	69. 2	3. 00	66. 7	4. 5	64. 1	2. 4	64. 4	1. 7	64. 1	1. 7	62. 7	7. 0	65. 2	3. 80	62. 4	2. 52	61. 9	8. 24
Delaware	1	......	......	66. 5	......	......	......	68. 4	2. 5	71. 8	2. 7	......	4. 8	68. 9	3. 30	......	......	66. 7	8. 80
Maryland	5	70. 4	3. 25	67. 8	8. 0	66. 7	2. 2	66. 3	1. 4	65. 1	3. 6	66. 3	8. 4	67. 2	4. 46	61. 1	......	67. 1	3. 33
District of Columbia	1	......	......	70. 1	2. 9	67. 4	1. 9	......	1. 6	66. 5	2. 9	67. 2	5. 8	67. 8	3. 00	63. 3	3. 09	66. 0	2. 57
South Carolina	5	75. 6	6. 53	78. 2	3. 0	72. 6	2. 1	75. 2	1. 4	72. 0	6. 0	74. 1	3. 1	74. 6	3. 67	......	......	86. 8	2. 86
Tennessee	2	78. 3	1. 96	73. 8	7. 3	65. 1	1. 4	70. 2	1. 4	69. 7	1. 8	69. 4	3. 4	71. 0	2. 91	......	......	68. 9	2. 06
Kentucky	4	77. 1	0. 75	74. 5	4. 7	64. 8	1. 4	69. 1	2. 3	67. 3	2. 8	67. 4	3. 2	70. 0	2. 54	......	......	67. 8	4. 33
Ohio	18	71. 5	1. 61	69. 7	5. 4	63. 3	2. 4	65. 4	1. 4	65. 0	1. 6	62. 9	3. 4	66. 3	2. 69	62. 1	2. 18	63. 4	5. 38
Michigan	8	66. 6	3. 67	65. 0	6. 0	57. 8	3. 1	61. 6	2. 6	60. 3	3. 1	63. 5	3. 3	62. 4	3. 61	56. 5	1. 98	62. 7	3 34
Indiana	4	71. 3	2. 78	71. 5	5. 7	63. 1	0. 7	67. 7	1. 6	66. 2	2. 9	65. 2	5. 4	67. 5	3. 21	64. 5	2. 05	65. 0	4. 24
Illinois	13	71. 6	1. 69	60. 9	2. 6	63. 3	3. 0	66. 4	2. 2	65. 1	3. 7	62. 3	3. 0	66. 4	2. 70	63. 2	3. 07	66. 0	3. 45
Wisconsin	9	65. 6	2. 39	63. 0	4. 5	58. 4	3. 5	61. 8	3. 8	60. 6	4. 1	58. 0	3. 0	61. 3	3. 57	58. 3	1. 27	59. 7	4. 33
Minnesota	3	60. 7	3. 19	60. 4	......	49. 9	......	60. 0	3. 0	57. 8	3. 6	55. 4	3. 6	57. 4	3. 35	59. 1	1. 87	62. 2	1. 57
Iowa	8	67. 7	2. 61	67. 1	4. 7	61. 5	2. 9	65. 2	2. 4	63. 7	3. 7	61. 6	2. 9	64. 5	3. 19	62. 2	3. 65	63. 7	2. 79
Missouri	2	75. 4	1. 67	73. 1	3. 9	65. 6	2. 9	70. 0	2. 1	71. 3	3. 9	66. 4	4. 4	70. 3	3. 11	69. 0	2. 86	68. 3	4. 08
Kansas	4	......	......	......	......	......	......	70. 6	......	69. 8	2. 5	68. 3	1. 9	69. 5	2. 20	72. 6	0. 55	73. 3	2. 23
Nebraska Territory	2	......	......	......	......	......	......	75. 3	2. 5	64. 9	2. 6	63. 0	2. 1	67. 7	2. 40	65. 6	1. 75	66. 9	1. 77
California	2	64. 8	0. 68	......	......	71. 1	0. 0	65. 1	0. 0	68. 7	0. 0	68. 8	0. 0	67. 6	0. 14	......	......	......	......

I. OCTOBER, 1864—CURRENT WEATHER.

Place.	County.	Observer.	Date.	Maximum temp.	Date.	Minimum temp.	Mean temp.	Rain.
MAINE.				°		°	°	*In.*
Steuben	Washington	J. D. Parker	8	65	27	26	31.8	5.10
Lee	Penobscot	Edwin Pitman	7	64	27	26	44.5	3.95
West Waterville	Kennebec	B. F. Wilbur	7	66	27, 30	28	44.5	2.60
Gardiner	....do	Rev. F. Gardiner	4, 7	66	27	29	46.0	2.76
Lisbon	Androscoggin	Asa P. Moore	5	63	27	26	44.8	2.90
Cornishville	York	G. W. Guptill	4	66	10	31	45.4	3.95
Cornish	....do	Silas West	4, 5	60	10	24	40.9	3.80
NEW HAMPSHIRE.								
Stratford	Coos	Branch Brown	5	66	30	23	41.0	4.09
Shelburne	....do	F. Odell	6	69	12	26	45.5	......
Barnstead	Belknap	Charles H. Pitman	5	74	9, 10, 31	34	48.1	3.95
Claremont	Sullivan	Arthur Chase	6	68	30	27	46.0	5.95
Do	....do	S. O. Mead	5	66	12, 30	30	46.9	......
VERMONT.								
Lunenburg	Essex	H. A. Cutting	25	75	31	25	48.1	6.13
Craftsbury	Orleans	Jas. A. Paddock	6	63	29, 30	28	40.1	4.44
Burlington	Chittenden	Rev. McK. Petty	6	64	30	25	42.5	4.67
Middlebury	Addison	H. A. Sheldon	3	66	30	32	47.6	3.92
MASSACHUSETTS.								
Sandwich	Barnstable	N. Barrows, M. D	7	68	30	31	49.2	2.28
West Dennis	....do	Eugene Tappan	7	69	10	35	51.0	1.94
Newbury	Essex	John G. Caldwell	4	69	30	28	46.3	......
Topsfield	....do	A. M. Merriam	4	71	22	34	46.8	3.79
New Bedford	Bristol	Samuel Rodman	7	68	10	33	48.4	2.39
State L. Hospital	Worcester	F. H. Rice	4	70	10, 12	34	50.5	4.29
Mendon	....do	J. G. Metcalf, M.D	5, 7	69	10	31	47.5	......
Baldwinsville	....do	Rev. E. Dewhurst	7	62	10	27	....	4.20
Amherst	Hampshire	Prof. E. S. Snell	4	69	22	29	46.4	2.94
Springfield	Hampden	J. Weatherhead	4	78	10	28	47.1	2.07
Westfield	....do	Rev. E. Davis	4	72	18	28	46.9	3.43
Richmond	Berkshire	William Bacon	5	70	12	27	45.1	......
Williams College	....do	Prof. A. Hopkins	4, 5	63	12	30	45.6	3.60
RHODE ISLAND.								
Providence	Providence	Prof. A. Caswell	4, 7	70	9	35	48.2	2.85
CONNECTICUT.								
Pomfret	Windham	Rev. D. Hunt	4	68	10	30	46.0	4.93
Columbia	Tolland	Wm. H. Yeomans	5	78	10	32	50.9	......
Middletown	Middlesex	Prof. John Johnston	5	72	12	33	41.4	2.66
Colebrook	Litchfield	Charlotte Rockwell	4, 7	66	12	29	45.4	......
NEW YORK.								
Moriches	Suffolk	Mrs. & Miss Smith	7	75	22	34	55.0	2.75
Fort Ann	Washington	P. A. McMore	13	80	10	35	49.8	......
South Hartford	....do	G. M. Ingalsbe	3	73	30	32	49.4	4.35
Fishkill Landing	Dutchess	Wm. H. Denning	5	71	10, 12, 26	36	50.4	2.70
Garrison's	Putnam	Thomas B. Arden	4	69	10, 26	37	48.0	2.46
Throg's Neck	Westchester	F. M. Rogers	7	70	10, 18, 22	41	49.7	2.29
Deaf and Dumb Ins.	New York	Prof. O. W. Morris	5	73	10, 15	42	54.4	2.68
St. Xavier's College	....do	Rev. Jno. M. Aubier	7	70	10	40	52.6	2.16
Flatbush	Kings	Eli T. Mack	7	68	10	34	52.0	2.04
Schenectady	Schenectady	Harmon V. Swart	4	66	27	30	47.3	......
Gouverneur	St. Lawrence	C. H. Russell	6	67	30	25	47.8	4.30
South Trenton	Oneida	Storrs Barrows	....	....	....	....	....	6.33
Oneida	Madison	Dr. S. Spooner	6	69	22	32	46.8	7.11
Theresa	Jefferson	S. O. Gregory	3	66	30	29	44.5	6.26
Palermo	Oswego	E. B. Bartlett	3	69	26	27	44.2	6.00
Oswego	....do	Wm. S. Malcolm	3, 6	68	22	35	47.3	5.72
Skaneateles	Onondaga	W. M. Beauchamp	5	66	9	31	44.4	......
Baldwinsville	....do	John Bowman	6	65	22	33	44.7	......
Auburn	Cayuga	John B. Dill	6	70	9, 15, 18	38	48.4	......
Nichols	Tioga	Robert Howell	4	74	18	28	46.9	......
Palmyra	Wayne	Stephen Hyde	6	70	26	34	48.1	......

I. OCTOBER, 1864—CURRENT WEATHER—Continued.

Place.	County.	Observer.	Date.	Maximum temp.	Date.	Minimum temp.	Mean temp.	Rain.
NEW YORK—Cont'd.				°		°	°	In.
Geneva	Ontario	Rev. W. D. Wilson	6	67	9	34	47.0	4.18
Rochester	Monroe	Prof. C. Dewey	6	72	26	32	46.5	5.51
Wilson	Niagara	E. S. Holmes, D.D.S.	6	73	26	34	47.2	
Buffalo	Erie	Wm. Ives	3	70	15, 26	34	47.0	5.73
Jamestown	Chautauqua	Rev. S. W. Roe, M.D.	4	72	15	29	46.3	7.80
NEW JERSEY.								
Newark	Essex	W. A. Whitehead	7	70	10	32	51.6	2.68
Mount Holly	Burlington	M. J. Rhees, M. D	6	75	10	35	51.8	
Burlington	....do	John C. Deacon	6	74	10	31	50.9	2.00
Progress	....do	Thomas J. Beans	6	76	10	34	51.5	1.79
Haddonfield	Camden	James S. Lippincott	6	75	10	35	51.3	1.85
Greenwich	Cumberland	Clarkson Sheppard	6	69	26	34	49.2	1.59
PENNSYLVANIA.								
Fallsington	Bucks	Ebenezer Hance	7	74	10, 18	37	52.3	1.80
Philadelphia	Philadelphia	Pf. J. A. Kirkpatrick	6	75	10	38	54.2	1.73
Do	....do	Homer Eachus	7	72	10	38	55.6	1.75
Germantown	....do	Thomas Meehan	7	78	10	31		
Moorland	Montgomery	Anna Spencer	6	72	18	34	51.4	2.30
Nazareth	Northampton	Lucius Ricksecker	7	79	18	32	50.6	
North Whitehall	Lehigh	Edward Kohler	5	70	10	29	50.5	
Silver Spring	Lancaster	H. G. Bruckhart	6	75	15, 30	32	50.0	
Berwick	Columbia	John Eggert	6	71	15	34	50.6	1.99
Harrisburg	Dauphin	John Heisely, M. D	6, 7	72	10	39	53.2	1.69
Tioga	Tioga	E. T. Bentley	4	78	15	26	47.3	2.30
Gettysburg	Adams	M. & H. E. Jacobs	6	76	10	32	49.4	2.67
Fleming	Centre	Samuel Brugger	4	74	10, 26	30	48.0	3.51
Pennsville	Clearfield	Elisha Fenton	4	75	18, 26	28	45.7	2.52
Blairsville	Indiana	W. R. Boyers	11, 14, 15, 22	58	9	30	48.0	6.70
Connellsville	Fayette	John Taylor	5	80	21	29	47.9	
Canonsburg	Washington	Rev. Wm. Smith, D.D	5	74	20, 22	30		
DELAWARE.								
Wilmington	New Castle	Dr. Urban D. Hedges	6	78	10	32	52.3	1.80
MARYLAND.								
Annapolis	Anne Arundel	Wm. R. Goodman	6	77	10, 21	35	54.8	3.20
Oakland	Howard	Philip Tabb	6	72	10	33	49.8	
Sykesville	Carroll	Miss H. M. Baer	6, 7	75	26	33	51.9	1.50
DIST. OF COLUMBIA.								
Washington	Washington	Smithsonian Inst'n	6	77	10	37	53.9	1.32
SOUTH CAROLINA.								
Beaufort	Beaufort	Mrs. M. M. Marsh	5, 6, 7, 12	82	23	52	60.3	
Hilton Head	....do	Lieut. C. R. Suter	2	92	29	50	68.1	2.70
TENNESSEE.								
Clarksville	Montgomery	Wm. M. Stewart	4	76	30	35	52.7	3.90
KENTUCKY.								
Louisville	Jefferson	Mrs. L. Young	4	78	9, 25, 30	30	51.3	3.52
OHIO.								
Saybrook	Ashtabula	James B. Fraser	6	72	25	33	47.8	2.75
Austinburg	....do	E. D. Winchester	6	73	26	30	51.0	2.15
New Lisbon	Columbiana	J. F. Benner	5	82	22	30	48.1	2.18
Welshfield	Geauga	B. F. Abell, A. M	3, 4, 5, 6	70	9	33	47.0	2.79
Cleveland	Cuyahoga	Mr. & Mrs. G. A. Hyde	6	75	25	36	50.4	1.63
Wooster	Wayne	Martin Winger	5	75	21	30	48.6	
Smithville	....do	John H. Myers	5	72	9, 14	34	48.2	
Gallipolis	Gallia	A. P. Rogers	5, 6	77	19, 20, 31	32	50.8	2.68
Kelley's Island	Erie	Geo. C. Huntington	6	70	9	35	51.2	3.20

I. OCTOBER, 1864—CURRENT WEATHER—Continued.

Place.	County.	Observer.	Date.	Maximum temp.	Date.	Minimum temp.	Mean temp.	Rain.
OHIO—Continued.								
				°		°	°	In.
Norwalk	Huron	Rev. A. Newton	6	71	25	31	47.6	2.84
Westerville	Franklin	Prof. H. A. Thompson	6	71	20	26	48.0	2.22
Kingston	Ross	Prof. J. Haywood	5	76	20	32	50.4	2.65
Portsmouth	Scioto	L. Engelbrecht	5	74	9, 31	37	52.6	2.65
Urbana	Champaign	Pf. M. G. Williams	6	68	25	27	46.8	1.89
Hillsborough	Highland	J. McD. Mathews	6, 7	71	9	33	50.6	2.19
Ripley	Brown	Dr. G. Bambach	4	79	20	33	53.2	2.43
Bethel	Clermont	George W. Crane	4	76	19, 20	31	46.4	4.88
Eaton	Preble	Miss Ollitippa Larsh	6	64	9	33	47.9	1.45
College Hill	Hamilton	John W. Hammitt	4	79	9	32	49.4	3.88
Do	....do	I. H. Wilson	4	71	23	36	51.3	3.15
Cincinnati	....do	G. W. Harper	4	82	19, 25	33	50.2	2.92
MICHIGAN.								
Pontiac	Oakland	James A. Weeks	5	64	21, 25	28	45.3	......
Monroe City	Monroe	Miss F. E. Whelpley	5	69	25	29	46.8	1.38
Agricultural College	Ingham	Prof. R. C. Kedzie	2	63	17	24	45.7	1.85
Garlick	Ontonagon	Edwin Ellis	13	60	24, 25	30	42.2	......
INDIANA.								
New Castle	Henry	T. B. Redding, A. M.	3,7,15,16	64	20	28	45.4	1.65
Spiceland	....do	Wm. Dawson	4	68	19, 20	30	47.6	1.89
New Albany	Floyd	Dr. E. S. Crozier	4	75	31	30	49.8	1.90
South Bend	St. Joseph	Reuben Burroughs	11	71	13, 20, 25	30	45.8	2.07
Indianapolis	Marion	Royal Mayhew	4	69	20	30	48.6	1.80
Do	....do	W. W. Butterfield	4	69	20	27	48.4	......
Bloomingdale	Park	Wm. H. Hobbs	6	70	9	30	....	......
Rensselaer	Jasper	Dr. J. H. Loughridge	4	68	9, 20	27	46.5	1.70
New Harmony	Posey	John Chappellsmith	4	72	21	25	51.1	1.13
ILLINOIS.								
Chicago	Cook	Samuel Brookes	14	68	17	25	45.0	......
Riley	McHenry	E. Babcock	14	70	17	21	44.5	2.13
Ottawa	La Salle	Mrs. E. H. Merwin	14	72	18	33	48.0	1.72
Winnebago	Winnebago	James W. Tolman	14	70	17, 18	27	45.5	2.28
Tiskilwa	Bureau	Verry Aldrich	14	72	18	29	49.0	......
Wyanet	....do	E. S. & Miss Phelps	10, 14	70	18	26	50.1	3.13
Elmira	Stark	O. A. Blanchard	14	70	18	27	47.3	1.88
Peoria	Peoria	Frederick Brendel	14	72	9	34	50.1	1.53
Pekin	Tazewell	J. H. Riblett	14	72	9, 13	30	49.9	1.42
Hoyleston	Washington	J. Ellsworth	3	76	31	29	49.8	1.50
Waverly	Morgan	Timothy Dudley	10, 11	76	31	32	50.1	1.75
Galesburg	Knox	Prof. Wm. Livingston	12	69	18	29	47.1	2.60
Vermont	Fulton	....	11, 14, 26	68	18	31	54.7	2.66
Augusta	Hancock	S. B. Mead, M. D.	14	69	31	31	48.1	2.90
WISCONSIN.								
Manitowoc	Manitowoc	Jacob Lüps	5	62	25	30	46.1	1.70
Milwaukee	Milwaukee	Carl Winkler	11	60	17	29	46.7	1.55
Do	....do	I. A. Lapham, LL.D.	11, 14	60	17	28	45.7	1.63
Green Bay	Brown	Friedrich Deckner	3	62	17, 18	27	44.7	1.39
Geneva	Walworth	Wm. H. Whiting	14	69	9, 16	30	45.6	......
Delavan	....do	Leveus Eddy	14	70	17	24	43.7	1.74
Waupacca	Waupacca	H. C. Mead	14	68	17, 25	30	45.8	......
Embarrass	....do	Edward E. Breed	4	62	13, 17	22	42.8	1.79
Beloit	Rock	Henry D. Porter	14	67	17	26	44.5	1.89
MINNESOTA.								
Beaver Bay	Lake	C. Wieland	9	60	8	29	42.9	2.13
St. Paul	Ramsey	Rev. A. B. Paterson	13	68	16	25	44.9	1.60
New Ulm	Brown	Charles Roos	13	74	22	29	47.3	2.34
IOWA.								
Lyons	Clinton	P. J. Farnsworth, M. D.	14	70	13	30	48.6	3.45
Dubuque	Dubuque	Asa Horr, M. D.	14	65	13, 18	30	48.1	2.81
Muscatine	Muscatine	I. P. Walton	14	64	13	26	46.7	3.11
Guttenberg	Clayton	P. Dorweiler	1, 13, 14	62	18	29	46.6	2.40

I. OCTOBER, 1864—CURRENT WEATHER—Continued.

Place.	County.	Observer.	Date.	Maximum temp.	Date.	Minimum temp.	Mean temp.	Rain.
IOWA—Continued.				°		°	°	*In.*
Monticello	Jones	....	13	67	18	24	43.8	2.55
Independence	Buchanan	D. S. Deering	14	68	18	27	46.0	......
Do	....do	A. C. Wheaton	14	70	13, 18	26	46.1	2.06
Mount Vernon	Linn	Rev. Alonzo Collin	14	63	18	28	46.2	......
Iowa City	Jefferson	Theo. S. Parvin, A.M	14	68	18	26	47.8	4.55
Fort Madison	Lee	Daniel McCready	2	70	18	29	49.1	3.47
Iowa Falls	Hardin	N. Townsend	3	68	8, 18	32	45.7	4.62
Algona	Kossuth	Dr. & Miss L. McCoy	13	66	31	26	43.0	2.31
MISSOURI.								
St. Louis	St. Louis	George Engelman	11	73	31	34	51.7	3.15
Allenton	....do	Aug. Fendler	11	76	30, 31	25	47.3	2.13
Canton	Lewis	George P. Ray	11, 14	75	31	25	47.3	5.31
Harrisonville	Cass	John Christian	11	78	22	30	52.4	2.81
Easton	Buchanan	P. B. Sibley	11	71	18, 19	29	....	2.93
KANSAS.								
State Agric. College.	Riley	H. L. Denison	11	73	22, 29	25	46.0	0.68
Fort Riley	Davis	James H. Pine	11	84	28	28	55.0	......
NEBRASKA TER.								
Elkhorn	Washington	Miss A. M. J. Bowen.	13	70	18, 28	26	44.8	......
Bellevue	Sarpy	Rev. Wm. Hamilton.	1	71	28, 29	28	46.6	4.23
MISSISSIPPI.								
Natchez	Adams	Robert McCary	1	80	22, 23	34	59.9	4.40
UTAH TERRITORY.								
Great Salt Lake City	Great Salt Lake	W. W. Phelps	10	76	27	31	53.5	3.75

II. OCTOBER—AVERAGES.

States and Territories.	Av. number of places.	Averages, 1854. Mean temp.	Averages, 1854. Mean rain.	Averages, 1855. Mean temp.	Averages, 1855. Mean rain.	Averages, 1856. Mean temp.	Averages, 1856. Mean rain.	Averages, 1857. Mean temp.	Averages, 1857. Mean rain.	Averages, 1858. Mean temp.	Averages, 1858. Mean rain.	Averages, 1859. Mean temp.	Averages, 1859. Mean rain.	Averages for six years. Mean temp.	Averages for six years. Mean rain.	Averages, 1863. Mean temp.	Averages, 1863. Mean rain.	Averages, 1864. Mean temp.	Averages, 1864. Mean rain.
		Deg.	*In.*	*Deg.*	*In.*	*Deg.*	*In.*	*Deg.*	*In.*	*Deg.*	*In.*	*Deg.*	*In.*	*Deg.*	*In.*	*Deg.*	*In.*	*Deg.*	*In.*
Maine	6	46.5	4.41	48.4	7.0	48.0	4.9	47.0	6.8	47.0	4.7	42.4	1.9	46.6	4.99	48.2	4.74	42.6	3.58
New Hampshire	3	50.4	3.02	50.2	9.2	47.4	2.8	47.1	6.6	45.3	6.3	41.0	1.9	46.9	4.92	46.2	3.74	45.5	4.50
Vermont	4	49.3	1.56	46.7	6.0	46.0	2.1	45.6	5.2	47.6	4.1	41.2	1.7	46.1	3.43	49.5	3.86	44.6	4.79
Massachusetts	12	52.8	3.19	47.4	9.3	50.6	2.4	49.6	4.1	52.2	3.1	46.4	2.2	49.8	4.03	52.3	3.13	49.2	3.09
Rhode Island	1	52.9	1.90	....	....	....	....	50.5	2.9	54.2	2.8	48.0	2.6	51.4	2.58	51.4	2.97	....	....
Connecticut	4	52.8	10.48	52.3	10.0	50.9	1.8	51.3	5.0	53.3	3.0	46.8	1.4	58.7	5.16	50.7	4.25	45.9	3.80
New York	17	53.4	2.51	49.2	5.0	49.1	1.8	48.4	4.9	52.8	3.1	46.1	1.6	49.8	3.17	49.0	3.42	48.0	4.47
New Jersey	4	54.8	2.52	51.8	4.6	52.8	1.4	55.2	3.5	55.2	1.6	47.5	2.7	52.9	2.75	54.1	4.52	51.1	1.98
Pennsylvania	19	56.1	2.37	50.6	3.6	51.3	1.7	52.1	3.0	55.9	2.3	48.7	1.8	52.4	2.48	50.7	4.96	50.3	2.63
Delaware	1	....	....	51.7	....	....	....	56.3	3.8	62.2	2.6	....	3.3	56.7	3.20	....	....	52.3	1.80
Maryland	4	57.1	2.99	52.0	3.8	53.8	3.1	54.2	2.4	56.8	3.0	50.4	2.4	54.0	2.92	55.6	3.21	52.2	2.35
District of Columbia	1	57.9	....	53.9	3.5	54.8	1.8	54.6	1.9	58.4	2.5	51.7	2.5	55.1	2.50	54.1	5.02	....	....
South Carolina	5	62.3	1.28	62.6	0.8	62.1	2.3	61.9	1.5	68.0	1.6	66.9	0.6	64.0	1.38	....	....	64.2	2.70
Tennessee	2	61.7	4.30	54.7	1.2	58.5	2.5	56.9	2.2	62.2	2.3	55.7	1.3	59.9	2.30	....	....	52.7	3.90
Kentucky	4	60.8	4.14	53.2	1.2	56.6	1.8	53.5	3.0	59.0	3.5	52.9	1.6	56.1	2.52	51.0	5.89	51.3	3.52
Ohio	20	56.9	3.81	50.4	2.8	53.1	1.7	49.7	4.5	55.5	3.5	46.3	2.2	52.0	3.05	48.0	3.18	49.4	2.66
Michigan	7	56.4	3.75	46.4	3.5	48.5	2.6	46.2	2.1	51.1	3.1	45.5	2.8	49.0	2.96	45.6	2.34	45.0	1.62
Indiana	5	55.5	4.18	50.9	1.3	55.4	1.5	51.4	2.6	55.9	3.6	51.3	2.6	53.4	2.61	46.9	3.70	47.9	1.73
Illinois	14	58.2	4.52	51.2	2.8	55.7	3.0	50.5	2.2	53.4	3.6	48.9	1.7	53.0	2.09	44.6	3.79	48.5	2.13
Wisconsin	6	54.2	3.29	45.9	2.4	49.3	2.5	46.7	3.1	48.9	3.2	44.7	2.0	48.3	2.72	43.0	2.75	45.1	1.67
Minnesota	3	....	....	....	....	49.6	2.7	46.9	0.8	44.1	1.6	41.7	1.3	45.6	1.60	39.2	1.37	45.0	2.02
Iowa	9	55.8	3.84	47.7	3.1	53.2	6.6	49.2	2.2	51.2	4.6	48.4	0.8	51.0	3.47	42.7	3.66	46.5	3.13
Missouri	2	57.5	3.53	53.9	3.9	60.0	2.2	71.1	1.9	58.6	7.7	54.5	1.8	59.3	3.51	47.6	3.87	49.7	3.27
Kansas	3	....	....	....	....	....	....	54.3	....	56.9	6.6	54.3	0.5	55.2	3.60	49.1	1.39	50.5	0.68
Nebraska Territory	3	....	....	....	....	....	....	48.9	3.9	51.9	6.0	51.6	1.3	54.1	3.70	39.6	0.75	45.7	4.23
California	2	61.5	0.94	....	....	58.2	0.2	61.5	0.4	50.5	2.6	65.4	0.2	61.4	0.91	....	....	....	....

I. NOVEMBER, 1864—CURRENT WEATHER.

Place.	County.	Observer.	Date.	Maximum temp.	Date.	Minimum temp.	Mean temp.	Rain.
MAINE.								
				°		°	°	*In.*
Steuben	Washington	J. D. Parker	9, 10	54	24	18	37.2	6.20
Lee	Penobscot	Edwin Pitman	10	58	17, 24	16	36.2	4.65
West Waterville	Kennebec	B. F. Wilbur	10	58	17	18	35.8	4.85
Gardiner	....do	Rev. F. Gardiner	10	61	17	17	37.8	5.77
Lisbon	Androscoggin	Asa P. Moore	10	60	17	13	36.8	7.09
Cornish	York	Silas West	10	58	17	14	33.6	5.70
Cornishville	....do	G. W. Guptill	10	62	24	18	36.2	6.36
NEW HAMPSHIRE.								
Stratford	Coos	Branch Brown	10	60	24	12	32.3	3.78
Shelburne	....do	Fletcher Odell	10	60	3	16	35.8	......
Claremont	Sullivan	Stephen O. Mead	9	65	17	15	37.6	......
VERMONT.								
Lunenburg	Essex	Hiram A. Cutting	10	55	18, 24	15	33.9	3.70
Craftsbury	Orleans	Jas. A. Paddock	9	58	24	16	32.0	4.05
Middlebury	Addison	H. A. Sheldon	12	65	24	19	38.9	2.22
MASSACHUSETTS.								
Sandwich	Barnstable	N. Barrows, M. D.	30	68	24	22	42.6	4.31
Topsfield	Essex	A. M. Merriam	9	66	15, 17	24	43.0	3.85
Newbury	....do	John H. Caldwell	9, 10	65	24	19	....	......
New Bedford	Bristol	Samuel Rodman	30	69	24	24	42.5	4.06
State Lunatic Hosp'l.	Worcester	F. H. Rice	9	62	17	18	41.7	4.81
Mendon	....do	J. G. Metcalf, M. D.	10	63	17	19	40.7	......
Baldwinsville	....do	Rev. E. Dewhurst	30	59	17, 24	13	33.7	4.92
Amherst	Hampshire	Prof. E. S. Snell	9	61	17	11	38.0	6.20
Springfield	Hampden	J. Weatherhead	30	68	15, 17	10	38.3	5.16
Westfield	....do	Rev. E. Davis	30	65	17	15	38.4	5.23
Williams College	Berkshire	Prof. A. Hopkins	10	64	17	12	37.0	4.17
Richmond	....do	Wm. Bacon	9	68	16	14	37.1	......
CONNECTICUT.								
Pomfret	Windham	Rev. D. Hunt	29	60	24	20	39.3	5.47
Columbia	Tolland	Wm. H. Yeomans	30	72	17, 24	20	41.9	......
Middletown	Middlesex	Prof. John Johnston	30	68	17	18	41.3	4.13
Colebrook	Litchfield	Charlotte Rockwell	9	61	15, 17	12	37.3	......
NEW YORK.								
Moriches	Suffolk	Mrs. & Miss N. Smith	30	72	15, 24	23	46.0	6.46
South Hartford	Washington	G. M. Ingalsbe	9	68	15, 17	10	39.4	5.10
Fishkill Landing	Dutchess	Wm. H. Denning	9, 10	63	24	22	41.7	2.76
Garrison's	Putnam	Thos. B. Arden	10	65	24	20	39.8	4.41
White Plains	Westchester	Oliver R. Willis	30	67	24	20	42.2	......
Throg's Neck	....do	F. M. Rogers	30	68	24	24	44.6	3.88
Deaf and Dumb Inst	New York	Prof. O. W. Morris	30	70	24	26	46.9	5.16
St. Xavier's College	....do	Rev. Jno. M. Aubier	30	68	24	25	44.7	4.51
Flatbush	King's	Eli T. Mack	30	66	15	23	43.9	4.83
Newburgh	Orange	James H. Gardiner	10	67	16, 24	28	42.0	......
Schenectady	Schenectady	Harmon V. Swart	9	64	15, 17	18	37.2	......
Gouverneur	St. Lawrence	Cyrus H. Russell	9	63	24	2	33.8	5.78
South Trenton	Oneida	Storrs Barrows	....	....	....	......	....	2.13
Theresa	Jefferson	S. O. Gregory	9	64	24	13	35.2	5.42
Oswego	Oswego	Wm. S. Malcolm	9	66	24	20	38.2	4.44
Palermo	....do	E. B. Bartlett	9	66	24	14	35.7	5.90
Skaneateles	Onondaga	W. M. Beauchamp	9	64	24	20	36.5	......
Baldwinsville	....do	John Bowman	9	64	24	20	36.6	......
Auburn	Cayuga	John B. Dill	9	70	24	20	39.5	......
Nichols	Tioga	Robert Howell	9	66	24	16	39.0	......
Palmyra	Wayne	Stephen Hyde	9	67	23, 24	27	41.5	......
Geneva	Ontario	Rev. W. D. Wilson	9	65	24	22	38.8	2.44
Rochester	Monroe	Prof. C. Dewey	9	68	23	20	38.5	2.66
Wilson	Niagara	E. S. Holmes, D. D. S.	9	67	16	23	39.0	......
Buffalo	Erie	Wm. Ives	9	66	16	21	38.5	3.48
Jamestown	Chautauqua	Rev. S. W. Roe, M. D.	9	65	23	12	37.4	3.80
NEW JERSEY.								
Newark	Essex	W. A. Whitehead	30	67	24	21	42.2	3.95
New Brunswick	Middlesex	G. W. Thompson	9	68	24	23	....	......

I. NOVEMBER, 1864—CURRENT WEATHER—Continued.

Place.	County.	Observer.	Date.	Maximum temp.	Date.	Minimum temp.	Mean temp.	Rain.
NEW JERSEY—Con.				°		°	°	In.
Burlington	Burlington	John C. Deacon	9	67	24	18	42.8	4.00
Progress	....do	Thos. J. Beans	9	68	24	18	42.5	4.06
Mount Holly	....do	M. J. Rhees, M. D	9	70	24	21	44.4	......
Haddonfield	Camden	Jas. S. Lippincott	9	71	24	19	43.6	3.53
Greenwich	Cumberland	R. C. Sheppard	9	61	24	17	39.8	3.10
PENNSYLVANIA.								
Fallsington	Bucks	Ebenezer Hance	9, 30	68	24	22	43.5	3.20
Philadelphia	Philadelphia	Pf. J. A. Kirkpatrick.	30	69	24	25	45.0	4.07
Germantown	....do	Thomas Meehan	10	70	23, 25	22	....	......
Moorland	Montgomery	Anna Spencer	9	66	24	20	42.5	4.97
Nazareth	Northampton	L. E. Ricksecker	9	65	24	22	40.3	......
North Whitehall	Lehigh	Edward Kohler	30	67	24	19	41.7	......
West Chester	Chester	Pfs. Clark & Aldrich.	30	69	23	21	45.3	......
Mount Joy	Lancaster	J. R. Hoffer	9	70	24	23	46.1	2.35
Silver Spring	....do	H. G. Bruckhart	9	68	24, 25	21	42.0	......
Berwick	Columbia	John Eggert	9	68	24	19	42.1	2.04
Harrisburg	Dauphin	John Heisely, M. D.	9	68	24	26	43.8	2.51
Tioga	Tioga	E. T. Bentley	9	71	24	16	40.0	2.05
Fleming	Centre	Samuel Brugger	9	69	23, 24	20	38.6	2.69
Pennsville	Clearfield	Elisha Fenton	9	65	23	9	36.2	3.96
Blairsville	Indiana	W. R. Boyers	9	76	23, 25	15	42.0	6.13
Connellsville	Fayette	John Taylor	9	78	23	14	41.9	......
Canonsburg	Washington	Rev. W. Smith, D.D.	9	70	23	11	39.8	3.98
DELAWARE.								
Wilmington	New Castle	U. D. Hedges, M. D.	9, 30	68	24	20	43.9	4.80
DIST. OF COLUMBIA.								
Washington	Washington	Smithsonian Instit'n.	30	69	24, 25	25	44.7	3.51
MARYLAND.								
Annapolis	Anne Arundel	Wm. R. Goodman	30	68	24	22	45.8	3.66
St. Mary's	St. Mary's	Rev. J. Stephenson	30	72	24	24	48.8	2.30
Sykesville	Carroll	Miss H. M. Baer	29	69	25	15	42.1	3.50
Ellicott's Mills	Howard	Philip Tabb	9	68	23	18	42.2	......
SOUTH CAROLINA.								
Hilton Head	Beaufort	Capt. Chas. R. Suter.	9	75	24	28	58.2	2.76
Beaufort	....do	M. M. Marsh, M. D.	18	80	23	24	57.1	3.24
MISSISSIPPI.								
Natchez	Adams	Robert McCary	8	80	23	20	56.2	9.77
TENNESSEE.								
Clarksville	Montgomery	Wm. M. Stewart	29	69	22	18	47.4	7.63
KENTUCKY.								
Louisville	Jefferson	Mrs. L. Young	29	72	23	12	45.1	6.30
OHIO.								
Austinburg	Ashtabula	E. D. Winchester	9, 29	66	23	12	38.9	3.55
Saybrook	....do	James B. Fraser	29	68	23	16	40.1	3.15
New Lisbon	Columbiana	J. F. Benner	9	72	23	14	42.6	1.63
East Fairfield	....do	S. B. McMillan	9	68	23	17	39.4	3.23
Steubenville	Jefferson	R. Marsh	....	71	....	18	....	3.65
Welshfield	Geauga	B. F. Abell, A. M.	9	66	23	15	39.1	4.41
Milnersville	Guernsey	Rev. D. Thompson	9	74	22	14	42.3	2.30
Cleveland	Cuyahoga	Mr. and Mrs. G. Hyde	9	71	23	18	42.6	3.51
Cuyahoga Falls	Summit	D. M. Rankin	9	72	23	16	....	3.63
Smithville	Wayne	J. H. Myers	9	70	23	14	41.3	......
Wooster	....do	Martin Winger	29	71	23	12	40.5	......
Gallipolis	Gallia	A. P. Rogers	9	74	23	14	44.1	3.60
Kelley's Island	Erie	Geo. C. Huntington.	9	65	23	18	41.0	4.43
Norwalk	Huron	Rev. A. Newton	29	68	23	14	40.4	2.98

I. NOVEMBER, 1864—CURRENT WEATHER—Continued.

Place.	County.	Observer.	Date.	Maximum temp.	Date.	Minimum temp.	Mean temp.	Rain.
OHIO—Continued.				°		°	°	In.
Westerville	Franklin	Pf. H. A. Thompson	9	70	23	12	42.9	2.55
Kingston	Ross	Pf. John Haywood	9	75	23	14	42.2	2.92
Portsmouth	Scioto	L. Engelbrecht	9	76	23	19	45.2	4.60
Urbana	Champaign	Pf. M. G. Williams	9, 29	68	23	10	41.1	3.53
Hillsborough	Highland	J. McD. Mathews	9	70	23	11	44.3	3.78
Ripley	Brown	Dr. G. Bambach	9, 29	71	23	16	45.6	5.17
Bethel	Clermont	George W. Crane	9	71	22, 23	10	36.2	3.56
Eaton	Preble	Miss Ollitippa Larsh	29	68	23	9	40.6	2.15
Cincinnati	Hamilton	R. C. Phillips	29	72	23	12	47.0	3.36
Do	....do	Geo. W. Harper	29	71	23	13	43.6	3.40
College Hill	....do	Isaiah H. Wilson	9	70	23	12	45.3	3.80
Do	....do	John W. Hammitt	9	70	23	10	42.9	......
MICHIGAN.								
Pontiac	Oakland	James A. Weeks	29	65	22	20	36.9	......
Monroe	Monroe	Miss F. E. Whelpley	29	67	23	15	38.7	2.55
State Agric'l College	Ingham	Prof. R. C. Kedzie	29	65	22	17	37.9	4.12
Garlick	Ontonagon	Edwin Ellis	28	52	22, 23	8	29.9	......
INDIANA.								
Spiceland	Henry	Wm. Dawson	29	70	23	8	40.4	6.00
New Castle	....do	Thos. B. Redding	29	69	23	7	38.5	4.32
South Bend	St. Joseph	R. Burroughs	29	68	23	0	37.6	6.34
Indianapolis	Marion	W. W. Butterfield	29	72	23	12	41.2	......
Do	....do	Royal Mayhew	29	72	23	11	41.5	4.34
Rensselaer	Jasper	Dr. J. H. Loughridge	29	68	23	10	37.3	9.05
New Harmony	Posey	Jno. Chappellsmith	29	72	22	18	45.3	3.83
Vevay	Switzerland	Charles G. Boerner	29	72	23	18	45.8	......
ILLINOIS.								
Chicago	Cook	Samuel Brookes	29	66	23	7	32.7	......
Riley	McHenry	E. Babcock	29	63	22	7	34.3	3.75
Ottawa	La Salle	Mrs. E. H. Merwin	29	70	22	3	36.3	3.29
Winnebago	Winnebago	James W. Tolman	29	62	22	6	33.6	2.27
Wyanet	Bureau	E. S. and Miss Phelps	29	70	21	5	38.4	2.78
Tiskilwa	....do	Verry Aldrich	28	64	22	10	38.2	......
Elmira	Stark	O. A. Blanchard	29	71	22	6	37.5	2.36
Hennepin	Putnam	Smiley Shepherd	29	70	....	22	37.1	......
Peoria	Peoria	Frederick Brendel	29	74	22	11	40.1	3.82
Pekin	Tazewell	J. H. Riblett	29	71	22	12	39.1	4.34
Hoyleston	Washington	J. Ellsworth	8, 29	74	22	10	42.7	......
Waverly	Morgan	Timothy Dudley	29	73	22	11	40.2	6.40
Galesburg	Knox	Pf. Wm. Livingston	19	67	22	7	34.4	2.90
Manchester	Scott	Dr. J. and Miss Grant	29	73	22	8	40.1	3.67
Augusta	Hancock	S. B. Mead, M. D.	29	70	22	6	38.1	3.86
WISCONSIN.								
Manitowoc	Manitowoc	Jacob Lüps	28	59	23	3	35.6	2.77
Milwaukee	Milwaukee	I. A. Lapham, LL.D.	20	60	23	3	32.1	2.61
Do	....do	Carl Winkler	29	61	23	5	35.9	3.27
Green Bay	Brown	Friedrich Deckner	28	52	23	—3	32.4	3.47
Geneva	Walworth	Wm. H. Whiting	29	58	22, 23	10	34.2	......
Delavan	....do	Leveus Eddy	29	58	22	6	33.3	1.74
Waupacca	Waupacca	H. C. Mead	29, 30	50	23	1	32.4	......
Embarrass	....do	Edward E. Breed	29	49	23	—2	30.0	4.16
Beloit	Rock	Henry D. Porter	29	60	22	5	33.4	4.00
Baraboo	Sauk	M. C. Wait	27	68	22	4	34.2	......
New Holstein	Calumet	J. Hachez	28	62	23	—1	32.3	2.30
MINNESOTA.								
Beaver Bay	Lake	C. Wieland	27	47	22	0	30.9	0.92
Ripley	....	Samuel Wilder	3	50	22	—10	26.9	0.60
New Ulm	Brown	Charles Roos	28	57	22	—5	32.1	1.56
Minneapolis	Hennepin	Wm. Cheney	28	53	22	—2	29.9	......
IOWA.								
Lyons	Clinton	P. J. Farnsworth, M. D.	28	62	22	8	35.6	2.80
Muscatine	Muscatine	I. P. Walton	28	64	22	5	34.7	2.54
Dubuque	Dubuque	Asa Horr, M. D.	29	57	22	4	34.1	2.37

I. NOVEMBER, 1864—CURRENT WEATHER—Continued.

Place.	County.	Observer.	Date.	Maximum temp.	Date.	Minimum temp.	Mean temp.	Rain.
IOWA—Continued.				°		°	°	*In.*
Guttenberg	Clayton	Philip Dorweiler	27, 28, 29	52	22	4	31.7	3.70
Monticello	Jones	Chauncey Mead	29	56	22	0	28.4	2.57
Independence	Buchanan	D. S. Deering	29	58	22	— 4	32.5	......
Do	....do	A. C. Wheaton	30	57	22	— 1	32.2	3.10
Iowa City	Johnson	T. S. Parvin, A. M.	28	58	22	0	35.8	4.82
Fort Madison	Lee	Daniel McCready	29	67	22	4	37.4	2.28
Waterloo	Black Hawk	T. Steed	29	58	22, 23	—18	33.8	......
Iowa Falls	Hardin	N. Townsend	5	50	21	4	31.0	2.17
Algona	Kossuth	Dr. F. & Miss McCoy	5, 28	54	22	— 6	29.6	......
MISSOURI.								
St. Louis	St. Louis	George Engleman	29	76	22	14	44.1	5.25
Allenton	....do	A. Fendler	29	76	22	11	42.6	3.90
Canton	Lewis	George P. Ray	28	70	22	6	38.0	3.28
Harrisonville	Cass	John Christian	27	64	22	4	38.4	3.81
Easton	Buchanan	P. B. Sibley	27	62	22	2	36.0	......
KANSAS.								
Olatha	Johnson	W. Beckwith	27	64	22	6	....	5.00
Lawrence	Douglas	A. N. Fuller	27	64	22	1	37.0	......
Agricultural College.	Riley	H. L. Denison	5, 29	58	22	10	36.6	1.61
Fort Riley	Davis	James H. Pine	25	70	22	10	39.8	1.40
NEBRASKA TER.								
Elkhorn	Washington	Miss A. M. J. Bowen.	5	56	22	1	33.1	......
Bellevue	Sarpy	Rev. Wm. Hamilton.	5, 6	56	22	3	34.3	1.45
MONTANA TER.								
Fort Laramie	....	Lt. Col. Wm. Collins.	12	69	8	1	36.9	......
UTAH TERRITORY.								
St. George	Washington	H. Pearce	14, 15	77	19	28	55.3	1.03
Great Salt Lake City.	Great Salt Lake.	W. W. Phelps	11	68	8, 17, 21, 23	25	40.2	1.19

II. NOVEMBER—AVERAGES.

States and Territories.	Av. number of places.	Averages, 1854.		Averages, 1855.		Averages, 1856.		Averages, 1857.		Averages, 1858.		Averages, 1859.		Averages for six years.		Averages, 1863.		Averages, 1864.	
		Mean temp.	Mean rain.	Mean temp.	Mean rain.	Mean temp.	Mean rain.	Mean temp.	Mean rain.	Mean temp.	Mean rain.	Mean temp.	Mean rain.	Mean temp.	Mean rain.	Mean temp.	Mean rain.	Mean temp.	Mean rain.
		Deg.	*In.*	*Deg.*	*In.*	*Deg.*	*In.*	*Deg.*	*In.*	*Deg.*	*In.*	*Deg.*	*In.*	*Deg.*	*In.*	*Deg.*	*In.*	*Deg.*	*In.*
Maine	6	37.9	8.13	37.1	4.9	35.1	3.1	37.1	3.3	30.7	2.1	35.5	4.7	35.6	4.36	39.4	6.4	36.2	5.80
New Hampshire	4	36.7	6.66	36.4	3.7	34.5	2.6	37.5	2.0	28.1	3.0	36.4	3.1	35.0	3.53	35.9	2.5	35.2	3.78
Vermont	5	36.7	2.25	34.6	1.3	33.2	2.3	35.7	2.2	30.2	2.9	35.8	3.2	34.4	2.38	38.1	2.5	34.9	3.32
Massachusetts	12	40.9	6.86	39.5	4.3	38.5	3.0	40.6	2.1	35.3	2.6	41.3	2.9	39.4	3.64	42.8	5.2	39.4	4.75
Rhode Island	1	....	9.15	42.0	3.8	39.4	2.0	42.3	2.4	37.2	2.4	43.3	2.3	40.9	3.69	43.3	7.5	....	......
Connecticut	5	40.7	9.13	42.6	3.3	40.7	3.5	40.7	3.0	35.5	3.2	41.7	2.6	40.4	4.11	43.1	5.3	40.0	4.80
New York	18	39.7	4.06	39.8	2.0	38.9	2.4	38.2	3.2	36.0	4.2	41.4	2.9	39.0	3.09	42.0	3.6	39.9	4.36
New Jersey	4	42.9	3.61	44.7	2.7	42.3	4.0	42.3	1.4	38.7	4.3	45.3	3.7	42.7	3.27	44.1	2.7	42.6	3.73
Pennsylvania	20	41.6	3.07	44.3	3.0	40.5	2.5	39.7	1.9	38.4	4.3	43.2	2.5	41.3	2.43	43.6	3.6	41.9	3.45
Delaware	1	42.8	....	44.5	....	44.7	....	47.0	2.4	44.4	5.1	....	3.5	44.7	3.70	....	....	43.9	4.80
Maryland	5	43.2	4.42	46.5	1.5	43.9	2.3	42.9	1.5	40.3	3.8	45.7	1.7	43.7	2.49	46.6	2.7	44.8	3.15
District of Columbia	1	45.3	....	48.3	1.1	44.0	2.2	42.3	1.3	41.5	4.2	48.1	1.9	44.9	2.10	47.0	1.7	....	......
South Carolina	6	49.8	1.48	59.9	1.4	57.2	3.3	64.8	2.5	49.3	2.8	59.6	2.6	56.7	2.33	....	....	57.7	3.00
Tennessee	1	44.9	2.35	52.6	4.7	44.3	6.0	45.6	5.7	41.6	2.9	51.7	4.7	46.8	4.39	....	....	47.4	7.63
Kentucky	1	42.8	3.33	51.4	3.6	43.5	4.1	42.2	2.8	39.9	2.6	48.8	3.0	44.7	3.22	45.7	3.1	45.1	6.30
Ohio	21	40.1	2.43	45.4	5.2	40.1	3.0	36.1	5.7	36.9	3.9	44.0	4.5	40.4	4.16	42.4	3.2	42.1	3.53
Michigan	8	36.8	1.86	39.8	5.2	34.5	3.1	31.7	2.9	35.4	3.7	38.3	3.8	36.1	3.48	38.3	1.9	35.9	3.34
Indiana	5	39.9	2.48	46.2	3.7	40.9	3.0	38.9	5.8	38.8	3.2	45.7	4.2	41.7	3.83	41.3	3.6	41.0	5.65
Illinois	14	42.7	0.73	41.8	2.8	35.0	3.6	33.0	2.7	34.8	3.8	40.8	2.9	38.0	2.79	38.7	1.4	37.5	3.59
Wisconsin	10	34.9	2.39	36.7	2.1	33.7	3.7	29.5	1.6	35.5	2.9	36.4	2.9	37.5	2.65	35.4	4.0	33.3	3.04
Minnesota	3	33.8	0.70	33.1	1.4	25.3	1.4	25.2	2.6	26.8	1.3	30.0	2.0	29.1	1.53	30.5	0.3	30.0	1.03
Iowa	8	36.8	0.58	36.1	3.1	33.5	3.5	30.7	3.5	31.3	3.7	38.7	2.0	34.5	4.43	34.8	2.9	33.1	2.97
Missouri	3	43.8	1.22	47.1	5.2	46.2	4.6	39.1	5.2	37.6	4.9	46.8	5.4	43.5	4.45	40.1	1.3	39.8	4.06
Kansas	3	....	....	....	....	....	....	35.5	3.6	34.3	2.2	45.0	0.7	38.3	2.20	40.6	1.9	37.8	2.67
Nebraska Territory	3	....	....	....	....	....	....	32.1	1.8	31.0	0.6	37.3	1.2	33.4	1.20	39.3	2.0	33.7	1.45
California	3	56.7	0.94	....	0.0	52.2	0.7	54.8	2.3	55.5	0.4	53.5	9.0	55.3	2.24	....	....	....	......

I. DECEMBER, 1864—CURRENT WEATHER.

Place.	County.	Observer.	Date.	Maximum temp.	Date.	Minimum temp.	Mean temp.	Rain or melted snow.
MAINE.				°		°	°	In.
North Perry	Washington	Wm. D. Dana	29	43	23	—15	22.5	5.56
Steuben	....do	J. D. Parker	7	45	23	—12	23.9	9.37
Lee	Penobscot	Edwin Pitman	29	47	24	—24	22.6	3.80
West Waterville	Kennebec	B. F. Wilbur	7	48	23	— 9	22.9	3.60
Lisbon	Androscoggin	Asa P. Moore	28	49	23	—11	23.8	4.25
Cornishville	York	G. W. Guptill	7	44	23	—11	23.8	4.87
Cornish	....do	Silas West	1	42	23	—12	22.9	4.68
NEW HAMPSHIRE.								
Shelburne	Coos	F. Odell	27	44	23	—11	23.1	3.42
Stratford	....do	Branch Brown	7	44	23	—19	19.5	5.19
North Barnstead	Belknap	Chas. H. Pitman	......	......	23	—10	......	......
Claremont	Sullivan	Arthur Chase	7	50	23	—18	25.4	2.97
Do	....do	S. O. Mead	7	52	23	— 7	25.7	......
VERMONT.								
Lunenburg	Essex	H. A. Cutting	28	46	20, 23	—10	22.6	......
Craftsbury	Orleans	Jas. A. Paddock	7	43	23	—16	19.5	5.00
Middlebury	Addison	H. A. Sheldon	7	54	23	—14	26.6	3.62
MASSACHUSETTS.								
Sandwich	Barnstable	N. Barrows, M. D	1, 3	51	23	— 3	33.2	4.41
Topsfield	Essex	A. M. Merriam	7	53	23	— 4	33.4	4.41
Newbury	....do	Jno. H. Caldwell	7	48	23	—10	28.7	......
New Bedford	Bristol	Sam'l Rodman	7	53	23	0	33.0	4.18
State Lunatic Hosp'l.	Worcester	F. H. Rice	7	53	23	— 4	29.5	3.67
Mendon	....do	Jno. G. Metcalf, M. D	7	54	23	— 4	24.6	......
Baldwinsville	....do	Rev. E. Dewhurst	7	48	23	—15	24.3	4.48
Amherst	Hampshire	Prof. E. S. Snell	7	51	23	0	30.2	4.63
Springfield	Hampden	J. Weatherhead	1	52	23	— 5	28.6	4.45
Westfield	....do	Rev. E. Davis	1	51	23	— 2	28.0	4.98
Williams College	Berkshire	Prof. A. Hopkins	7	51	23	— 6	26.6	4.18
Richmond	....do	Wm. Bacon	28	53	23	— 4	25.6	9.67
CONNECTICUT.								
Pomfret	Windham	Rev. D. Hunt	1	49	23	— 1	28.3	6.22
Columbia	Tolland	Wm. H. Yeomans	1	60	23	— 4	31.1	......
Middletown	Middlesex	Prof. Jno. Johnston.	7	55	23	0	31.0	3.99
Colebrook	Litchfield	Charlotte Rockwell.	7	52	23	—10	26.0	......
NEW YORK.								
Moriches	Suffolk	Mrs. and Miss Smith.	1	61	23	9	37.0	8.21
South Hartford	Washington	G. M. Ingalsbe	3	48	23	—24	27.6	4.40
Newburgh	Orange	James H. Gardiner	1	57	22	10	......	7.00
Fishkill Landing	Dutchess	Wm. H. Denning	1	54	23	8	30.9	2.70
Garrison's	Putnam	Thos. B. Arden	7	53	23	9	24.6	3.97
White Plains	Westchester	Oliver R. Willis	3	57	23	3	33.7	......
Deaf and Dumb Inst.	New York	Prof. O. W. Morris	7	58	23	11	37.0	5.88
St. Xavier's College.	....do	Rev. John Aubier	7	56	22	11	34.7	......
Flatbush	Kings	Eli T. Mack	1	55	12, 23	10	32.6	4.01
Schenectady	Schenectady	Harmon V. Swart	7	54	23	— 2	28.7	......
Gouverneur	St. Lawrence	C. H. Russell	3	49	23	—25	25.1	4.29
Clinton	Oneida	Dr. H. M. Paine	7	54	15	0	29.9	2.38
Oneida	Madison	Dr. S. Spooner	7	52	15	1	28.6	4.16
Theresa	Jefferson	S. O. Gregory	3	48	23	—29	23.1	5.18
Oswego	Oswego	Wm. S. Malcolm	3	54	13, 22, 23	— 7	28.7	4.24
Palermo	....do	E. B. Bartlett	3	51	15, 23	0	25.0	5.10
Baldwinsville	Onondaga	John Bowman	3	52	22	3	27.1	......
Skaneateles	....do	W. M. Beauchamp	3	51	23	3	26.4	......
Nichols	Tioga	Robert Howell	3, 7	54	15, 22	4	30.2	......
Auburn	Cayuga	John B. Dill	3	56	8, 22, 23	8	28.2	......
Palmyra	Wayne	Stephen Hyde	3	55	8	13	33.2	......
Geneva	Ontario	Rev. W. D. Wilson.	3	59	22	6	28.9	1.45
Rochester	Monroe	Prof. C. Dewey	3	54	23	7	28.7	2.67
Wilson	Niagara	Dr. E. S. Holmes	27	50	8, 22	9	27.6	......
Buffalo	Erie	Wm. Ives	3	50	8, 15	6	28.5	4.78
Jamestown	Chautauqua	Rev. S. W. Roe, M. D	2	52	11	2	25.9	6.00

I. DECEMBER, 1864—CURRENT WEATHER—Continued.

Place.	County.	Observer.	Date.	Maximum temp.	Date.	Minimum temp.	Mean temp.	Rain or melted snow.
NEW JERSEY.				°		°	°	*In.*
Paterson	Passaic	Wm. Brooks	1	56	12	6	33.3	2.37
Newark	Essex	W. A. Whitehead	1	56	23	5	32.7	4.76
New Brunswick	Middlesex	G. W. Thompson	7	58	23	8	33.1	......
Burlington	Burlington	John C. Deacon	7	58	12	8	33.6	3.90
Mount Holly	....do	M. J. Rhees, M. D	3, 7	59	12	14	35.4	......
Progress	....do	Thos. J. Beans	1	54	12, 13	11	33.4	5.17
Haddonfield	Camden	Jas. S. Lippincott	7	62	23	14	35.0	5.24
Greenwich	Cumberland	R. C. Sheppard	3	60	12, 23	16	35.7	3.84
PENNSYLVANIA.								
Fallsington	Bucks	Ebenezer Hance	1	59	23	10	35.0	4.30
Philadelphia	Philadelphia	Pf. J. A. Kirkpatrick	7	59	12	12	35.8	4.75
Germantown	....do	Thos. Meehan	1, 4	51	23	7	....	......
Mooreland	Montgomery	Anna Spencer	1	55	23	8	32.9	2.59
Nazareth	Northampton	L. E. Ricksecker	1	54	23	2	31.2	......
North Whitehall	Lehigh	Edward Kohler	1	52	15, 23	2	32.3	2.15
West Chester	Chester	T. H. Aldrich	1	61	12	8	34.9	......
Silver Spring	Lancaster	H. G. Bruckhart	7	56	25	8	33.3	......
Mountjoy	....do	J. R. Hoffer	3	58	12	10	35.9	4.00
Berwick	Columbia	John Eggert	7	55	23	6	33.3	1.43
Harrisburg	Dauphin	Dr. John Heisely	1	53	12	15	38.7	3.26
Tioga	Tioga	E. T. Bentley	7	53	9, 15	2	29.7	2.60
Gettysburg	Adams	M. and H. E. Jacobs	1	56	25	6	31.1	3.42
Fleming	Centre	Samuel Brugger	2, 7	50	9	3	28.6	3.14
Pennsville	Clearfield	Elisha Fenton	3	55	9	4	26.8	5.02
Blairsville	Indiana	W. R. Boyers	16	40	12	— 5	24.6	3.08
Connellsville	Fayette	John Taylor	2	60	9	1	32.4	......
Canonsburg	Washington	Rev. W. Smith, D. D	7	56	9	3	29.7	3.76
DELAWARE.								
Wilmington	New Castle	U. D. Hedges, M. D	1	56	12	10	36.4	7.45
MARYLAND.								
Annapolis	Anne Arundel	Wm. R. Goodman	7	60	12	14	38.0	4.83
Oakland	Howard	Philip Tabb	1, 3	56	23	6	33.5	......
Sykesville	Carroll	Miss H. M. Baer	3, 7	55	9, 12	10	30.1	3.55
DIST. OF COLUMBIA.								
Washington	Washington	Smithsonian Instit'n.	1, 3	57	9, 12, 23	18	36.3	[illegible]
SOUTH CAROLINA.								
Hilton Head	Beaufort	Capt. C. R. Suter	3	75	23	25	54.0	1.98
Beaufort	....do	M. M. Marsh, M. D	17	78	12	23	53.5	1.58
TENNESSEE.								
Clarksville	Montgomery	Wm. M. Stewart	1	71	12	3	37.8	3.87
KENTUCKY.								
Louisville	Jefferson	Mrs. L. Young	2	60	12	— 1	33.3	5.18
OHIO.								
Saybrook	Ashtabula	Jas. B. Fraser	2, 3	55	11	1	28.0	2.70
Austinburg	....do	E. D. Winchester	2	54	11	2	30.0	2.96
East Fairfield	Columbiana	S. B. McMillan	2	54	12	8	29.2	4.53
New Lisbon	....do	J. F. Benner	2	60	11	2	31.7	2.32
Steubenville	Jefferson	R. Marsh	....	60	....	6	31.9	3.52
Welshfield	Geauga	B. F. Abell, A. M	2	60	8	7	27.9	5.22
Milnersville	Guernsey	Rev. D. Thompson	2	60	23	3	29.3	3.66
Cleveland	Cuyahoga	Mr. and Mrs. G. A. Hyde.	2	56	8, 9, 23	12	30.1	2.72
Cuyahoga Falls	Summit	D. M. Rankin	2	53	11	— 3	26.2	......
Wooster	Wayne	Martin Winger	2	56	11	— 1	27.9	......
Smithville	....do	J. H. Myers	2	54	11	0	28.7	......
Gallipolis	Gallia	A. P. Rogers	7	65	23	8	34.2	4.34
Kelley's Island	Erie	Geo. C. Huntington	2	56	23	7	28.7	2.10
Norwalk	Huron	Rev. A. Newton	2	58	11	2	28.0	1.13
Westerville	Franklin	Pf. H. A. Thompson	2	55	23	— 5	28.2	2.24

I. DECEMBER, 1864—CURRENT WEATHER—Continued.

Place.	County.	Observer.	Date.	Maximum temp.	Date.	Minimum temp.	Mean temp.	Rain or melted snow.
OHIO—Continued.				°		°	°	In.
Kingston	Ross	Pf. John Haywood	3	59	11	4	31.5	3.76
Portsmouth	Scioto	L. Engelbrecht	3	64	11	9	34.3	4.35
Urbana University	Champaign	Pf. M. G. Williams	2	57	23	— 4	27.7	3.61
Ripley	Brown	Dr. G. Bambach	2	60	12	5	34.8	5.31
Bethel	Clermont	Geo. W. Crane	6, 7	53	11, 23	0	31.3	6.30
Eaton	Preble	Miss Ollitippa Larsh	2	56	12, 23	— 6	26.4	3.19
College Hill	Hamilton	John W. Hammitt	2	55	23	— 3	29.2	......
Do	....do	Isaiah H. Wilson	3	60	23	0	31.4	5.15
Cincinnati	....do	R. C. Phillips	2	60	12	9	35.8	3.15
Do	....do	George W. Harper	2	58	12	1	33.0	2.94
MICHIGAN.								
Pontiac	Oakland	James A. Weeks	2	52	9	— 8	26.2	......
Monroe	Monroe	Miss F. E. Whelpley	2	50	8, 9	0	26.9	2.33
State Agric'l College	Ingham	Prof. R. C. Kedzie	2	51	9	—17	24.4	3.20
Garlick	Ontonagon	Edwin Ellis	1	42	8	— 8	....	......
INDIANA.								
Vevay	Switzerland	Chas. G. Boerner	2	58	12	5	35.4	......
Pennville	Jay	Miriam Griest	7	46	23	—16	21.5	1.25
New Castle	Henry	T. B. Redding, A. M	2	58	23	—10	26.2	3.15
South Bend	St. Joseph	Reuben Burroughs	3	56	9	—17	23.5	4.85
Indianapolis	Marion	W. W. Butterfield	2	60	12, 23	— 3	27.5	......
Do	....do	R. Mayhew	2	60	12	— 5	27.7	3.42
New Harmony	Posey	John Chappellsmith	2	67	23	0	31.9	3.42
ILLINOIS.								
Chicago	Cook	Samuel Brookes	2	58	8	—20	18.2	......
Evanston	....do	A. D. Langworthy	....	......	8	—13	....	......
Riley	McHenry	E. Babcock	2	53	9	—24	19.2	2.56
Sandwich	DeKalb	Dr. N. E. Ballou	2	57	8	—22	19.3	2.25
Clinton	DeWitt	C. H. Moore	....	......	22	—10	....	......
Ottawa	La Salle	Mrs. E. H. Merwin	2	63	9	—23	18.7	3.49
Winnebago	Winnebago	James W. Tolman	2	56	9	—20	17.2	2.76
Tiskilwa	Bureau	Verry Aldrich	2	58	9	—13	21.8	......
Wyanet	....do	Mr. and Miss Phelps	2	62	9	—20	21.1	3.89
Hennepin	Putnam	Smiley Shepherd	2	57	9	—20	20.0	......
Peoria	Peoria	Frederick Brendel	2	67	8	— 6	25.6	3.06
Elmore	....do	W. H. Adams	....	......	....	......	....	4.12
Pekin	Tazewell	J. H. Riblett	2	67	9, 22	— 8	24.3	2.73
Hoyleston	Washington	J. Ellsworth	2	70	12	— 3	30.0	3.30
Waverly	Morgan	Timothy Dudley	2	70	22	— 6	26.2	2.75
Galesburg	Knox	Rev. W. Livingston	2	64	8, 9	—13	22.4	4.58
Manchester	Scott	Dr. and Miss Grant	2	66	11, 22	— 2	26.5	1.94
Augusta	Hancock	S. B. Mead, M. D	2	65	8, 11, 22	— 7	22.7	3.55
WISCONSIN.								
Manitowoc	Manitowoc	Jacob Lüps	2	48	8, 9	—16	22.4	1.85
Milwaukee	Milwaukee	I. A. Lapham, LL. D	2	53	8	—15	20.1	1.99
Green Bay	Brown	Friedrich Deckner	1	49	9	—16	18.0	2.17
Geneva	Walworth	William H. Whiting	2	56	9	—19	17.6	......
Delavan	....do	Leveus Eddy	2	55	8, 9	—21	17.5	2.39
Waupacca	Waupacca	H. C. Mead	1	49	8	—20	18.8	......
Embarrass	....do	Edward E. Breed	1, 2	42	8, 9	—18	17.9	2.25
Beloit	Rock	Henry D. Porter	1	50	9	—22	16.5	1.90
MINNESOTA.								
Beaver Bay	Lake	C. Wieland	1	40	8	—21	12.3	0.64
St. Paul	Ramsey	Rev. A. B. Paterson	1	46	14	—24	12.0	0.71
Minneapolis	Hennepin	Wm. Cheney	1	50	8	—21	11.0	......
New Ulm	Brown	Charles Roos	1	47	8, 22	—23	9.8	1.03
IOWA.								
Lyons	Clinton	Dr. P. J. Farnsworth	2	52	8	—16	18.2	5.30
Muscatine	Muscatine	I. P. Walton	2	55	8	—20	18.5	2.12
Dubuque	Dubuque	Asa Horr, M. D	2	52	8	—19	17.4	1.82
Guttenberg	Clayton	Philip Dorweiler	2	50	9	—18	15.8	2.72
Monticello	Jones	Chauncey Mead	2	52	9	—29	17.5	1.83

I. DECEMBER, 1864—CURRENT WEATHER—Continued.

Place.	County.	Observer.	Date.	Maximum temp.	Date.	Minimum temp.	Mean temp.	Rain or melted snow.
IOWA—Continued.				°		°	°	In.
Independence	Buchanan	A. C. Wheaton	2	51	8	—25	14.7	2.05
Do	...do	D. S. Deering	2	51	14	—16	17.5	......
Mount Vernon	Linn	Prof. A. Collins	1	53	8	—17	16.6	......
Iowa City	Johnson	Theo. S. Parvin, A. M	2	54	8	—14	19.3	2.03
Mount Pleasant	Henry	Rev. E. L. Briggs	2	62	8	—16	19.9	2.20
Fort Madison	Lee	Daniel McCready	2	63	8	—12	21.6	2.72
Waterloo	Black Hawk	T. Steed	2	50	14	—18	17.2	......
Iowa Falls	Hardin	N. Townsend	2	47	......	......	......	......
Algona	Kossuth	Dr. and Miss McCoy	1, 2, 26	40	8, 22	—18	13.4	0.13
MISSOURI.								
Allenton	St. Louis	Aug. Fendler	2	61	23	—10	28.2	1.63
Athens	Clark	J. T. Caldwell	25	58	11	— 8	....	2.10
Canton	Lewis	George P. Ray	2	63	8, 22	— 8	23.2	4.06
Harrisonville	Cass	John Christian	1, 2	56	22	— 8	24.6	2.25
Easton	Buchanan	P. B. Sibley	2	53	11	—11	21.9	0.94
KANSAS.								
State Agric'l College.	Riley	Henry L. Denison	1	58	11	— 6	28.0	1.11
Fort Riley	Davis	James H. Pine	1	68	11	— 3	28.2	......
NEBRASKA TER.								
Bellevue	Sarpy	Rev. Wm. Hamilton.	1	50	8	—14	19.9	0.34

II. DECEMBER—AVERAGES.

States and Territories.	Av. number of places.	Averages, 1854.		Averages, 1855.		Averages, 1856.		Averages, 1857.		Averages, 1858.		Averages, 1859.		Averages for six years.		Averages, 1863.		Averages, 1864.	
		Mean temp.	Mean rain.	Mean temp.	Mean rain.	Mean temp.	Mean rain.	Mean temp.	Mean rain.	Mean temp.	Mean rain.	Mean temp.	Mean rain.	Mean temp.	Mean rain.	Mean temp.	Mean rain.	Mean temp.	Mean rain.
		Deg.	*In.*	*Deg.*	*In.*	*Deg.*	*In.*	*Deg.*	*In.*	*Deg.*	*In.*	*Deg.*	*In.*	*Deg.*	*In.*	*Deg.*	*In.*	*Deg.*	*In.*
Maine	6	19.8	5.00	25.7	4.5	20.5	3.8	26.5	4.6	19.8	3.1	16.5	5.9	21.5	4.50	21.7	3.9	23.2	5.2
New Hampshire	4	21.2	2.60	26.8	5.4	17.7	3.1	28.7	4.3	17.7	2.9	17.7	4.5	21.6	3.77	17.3	3.5	23.4	3.9
Vermont	4	18.7	1.11	24.6	2.5	16.9	2.3	27.1	3.4	19.4	2.4	16.3	2.9	20.5	2.44	21.5	4.2	24.3	4.3
Massachusetts	12	25.0	3.06	30.3	5.8	24.6	4.2	33.0	5.2	29.1	3.8	25.1	5.0	27.8	4.51	26.9	4.4	28.8	4.9
Rhode Island	1	26.5	3.35	32.2	6.1	25.5	5.8	34.6	5.2	32.1	3.5	28.4	3.5	29.8	4.56	28.5	5.7	......	......
Connecticut	5	25.1	5.46	32.0	6.3	26.8	5.9	38.2	6.8	29.2	3.7	25.6	3.5	29.4	5.24	27.8	5.1	29.1	5.1
New York	18	24.8	2.38	29.1	3.5	25.1	3.4	33.1	4.0	29.2	3.3	23.5	3.9	27.5	3.40	28.7	3.8	29.3	4.6
New Jersey	4	28.6	1.78	34.3	5.1	30.9	3.6	35.9	5.4	34.0	4.2	30.8	4.3	32.4	2.05	31.4	4.4	34.0	4.2
Pennsylvania	20	29.7	3.44	30.7	4.9	28.4	2.9	36.6	4.9	34.8	1.5	29.1	4.0	31.5	3.57	34.7	4.4	32.1	3.4
Delaware	1	33.4	......	......	......	34.5	......	43.7	4.7	43.0	6.4	......	3.6	38.7	4.90	37.2	4.0	36.4	7.5
Maryland	5	31.7	4.32	35.4	1.1	31.2	2.8	38.8	6.0	38.1	4.0	33.4	3.7	34.8	3.64	35.3	4.4	33.9	4.2
District of Columbia	1	......	......	37.1	3.2	31.8	2.3	......	5.5	39.9	5.8	34.6	6.2	35.8	4.60	35.4	3.7	36.3	3.0
South Carolina	4	43.0	1.33	49.7	6.1	46.6	3.4	54.0	4.7	54.7	3.4	49.7	3.2	49.6	3.72	......	......	53.8	1.8
Tennessee	1	37.4	1.66	38.1	2.3	31.2	5.1	46.6	5.3	46.1	8.5	35.2	6.6	39.1	4.86	40.0	8.6	37.8	3.9
Kentucky	4	36.9	2.11	36.4	3.3	30.2	4.5	42.4	5.8	43.4	7.9	30.5	6.6	36.7	5.02	38.9	4.5	33.3	5.2
Ohio	20	30.6	1.91	31.6	3.7	24.7	3.3	37.1	3.5	36.7	5.1	25.6	4.3	31.0	3.65	35.0	4.2	30.2	3.7
Michigan	8	26.1	1.60	25.5	3.5	21.0	3.3	31.5	1.7	30.1	2.1	20.0	2.5	25.7	2.43	31.9	1.1	25.8	2.8
Indiana	4	38.6	1.38	31.7	2.5	28.8	3.3	37.4	2.2	39.2	6.0	26.8	4.3	33.8	3.23	34.9	3.8	27.7	3.2
Illinois	14	32.0	1.22	26.6	3.6	22.0	4.2	34.7	1.4	30.6	3.0	18.1	1.6	27.3	2.54	29.9	5.5	22.2	3.2
Wisconsin	10	24.8	2.26	19.5	2.2	15.6	4.1	29.9	2.3	24.0	2.0	14.0	0.9	21.3	2.29	27.6	4.6	18.6	2.1
Minnesota	4	13.4	......	9.9	1.3	4.9	......	23.4	1.4	14.7	1.3	5.9	0.6	12.1	1.20	20.6	1.3	11.3	0.8
Iowa	7	27.1	1.20	20.2	2.1	15.2	4.5	31.4	1.3	23.9	1.9	15.2	0.6	22.2	1.95	25.9	5.5	17.5	2.3
Missouri	3	37.2	1.19	32.1	3.1	29.8	4.3	40.0	2.6	38.3	8.5	24.5	2.4	33.6	3.70	31.1	5.3	24.5	3.0
Kansas	3	......	......	......	......	......	......	37.8	0.2	29.9	1.2	21.9	0.2	29.9	0.50	27.8	4.0	28.1	1.1
Nebraska Territory	3	......	......	......	......	......	......	32.1	0.8	20.1	0.9	15.0	0.5	22.6	0.70	21.9	3.4	19.9	0.3
California	3	52.9	0.56	......	0.0	43.9	2.4	49.6	2.5	45.6	5.5	45.8	2.9	47.3	2.26	44.2	3.5	......	......

LIST OF ARTICLES DONATED TO AGRICULTURAL MUSEUM.

Name.	Residence.	Articles.
Louis Perrot	Greenville, Onondaga county, Wis.	Skin of barred owl; skin of marmot or woodchuck; specimens of native copper and ores.
Dr. Henry Erni, (chemist department.)	Washington, D. C	Samples of sorghum sugars and sirups from Ohio Sorghum Association; samples of sorghum sugars and sirups from Baltimore, Md.; solidified tar, bituminous coal, and tar from Kentucky; corn sugar, crystalized with sulphuric acid; willow wood from Napoleon's grave; refined beet sugar in loaf from Messrs. Gennert Bros., Chatsworth, Ill.; Mexican wild hemp; Mexican wild cotton; Sandwich Island fibre; guano, nine varieties; package of West India sugar cane; asphaltum, from Cardenas, Havana.
J. S. Lippincott	Camden, N. J	Sorghum sirup, three bottles.
Michael Fryer	Wilmington, Del	Flax plant, four specimens; flax fibre, three specimens; flax cotton, three specimens.
Col. Livingston	Washington, D. C., (from New York.)	Vegetable velvet; smilax berry, seed, &c., substitute for coffee; egg of ray.
J. H. Sullivan		Specimen of upper oil rock, oil district of Pleasants county, Va.
Wm. Saunders, (Department garden.)	Washington, D. C	Specimen of rosin from rosin plant.
George Taylor	Hammerton, N. J	Specimen of broom corn.
Mr. Pickstone	Manchester, England	Oil stone, Canada oil formation; limestone from Lake Tunnel, Chicago.
L. J. Bradford	Augusta, Ky	Tobacco, premium specimen.
John Walker	Fayette, Howard county, Mo.	Samples of cashmere goat's wool.
Dr. J. M. Head	Gallatin, Tenn	Angora goat hair, colored.
R. O. Thompson	Nebraska	Lithographs, colored, of wine grape; mountain blackberry; mountain cherry; seedling and golden gem plum.
Maryland Sorghum Convention.		Sorghum sugars and sirups and alcohol.
Edward Starr	Minnesota	Seven-headed wheat.
J. S. Grinnell, (Dep't Agriculture.)	Washington, D. C	Emery rock, from Massachusetts.
Calvin T. Wright	Chelmsford, Mass	Northern flint corn.
S. Parkhurst	Middlesex, Mass	Flint corn, eight-rowed.
Charles Snyder	St. Peter, Minn	Specimen of corn; specimen of imphee.
R. Chute	St. Anthony, Minn	Crude fibre of tow; crude fibre of Bœhmeria or China grass.
Allen Dodge	Georgetown, D. C	Silver-spangled Poland fowl; game hen.
W. A. Megraw	Baltimore, Md	Fibre of wild pineapple from Mexico, used for making brushes.
Edward Young, (Census Bureau.)	Washington, D. C	Asphaltum from Hughes river, Va.; naphtha.
Charles Carpenter	Kelley's Island, Ohio	Specimens of injured grape-vines.
Ferdinand E. Hassler	Cape Vincent, N. Y	Jar of reptiles and insects; insects found in beech wood; water birds, (last all spoiled.)
S. W. Jewett	Kern river, Los Angelos, Cal.	Specimen of cotton.

DONATIONS TO AGRICULTURAL MUSEUM—Continued.

Name.	Residence.	Articles.
G. B. Wallace	Lowmoor, Iowa	Sorghum sirup, six bottles.
Watson Newbold	Columbus, N. J	Specimen of corn.
Unknown donor		Italian wheat, thirteen specimens.
Thomas Budd	Cecil county, Md	Printing paper from pressed stalks of sorghum.
Isaac Myers	Butler county, Ohio	Sorghum sirup and oil.
Hugh Burgess	Royer's Ford, Pa	Flax cotton, fine.
Reuben French	Pepperill, Mass	Cotton shoddy.
C. B. Thompson	Pleasant Hill, Del	Sorghum sugar; New Orleans cotton; sea island cotton; Egyptian cotton.
Lewis Bollman, (Department of Agriculture.)	Washington, D. C	Wild oats.
M. Guerin Méneville	Paris, France	Cocoons; eggs; specimens, &c., of attacus cynthia, yama mai, and other foreign silk-producing insects.
B. Dolbear	Washington Territory	Tobacco.
T. S. Gold	Cornwall, Conn	Tobacco.
J. P. Wortendyke	Godwinville, N. J	Twine of Manilla paper.
Julian Winne	Bethlehem, N. Y	Wool, two samples, Leicester.
Mr. Hubbard	Sierra Leone, Africa	African milk measure.
A. McFarland	New Athens, Ohio	Wool, merino.
John Duncan	Am. Fork, Utah	Sorghum sirup.
H. Sawyer		Papanjay or sponge cucumbers.
A. H. Wrenn	Mt. Gilead, Ohio	Corn, five specimens; sorghum; winter squash.
A. S. H. White, (Department of Interior.)	Washington, D. C	Wood from apple tree planted by Peregrine White, at Mansfield, Mass.
H. M. Arms	Springfield, Vt	Merino wools.
Mr. Dale	Maryland	Riga flax and thread; California flax and thread.
Eph. Young	New Jersey	Paper from salt grass.
W. R. Blackburn	New Paris, Pa	Spanish moss, Tillandsia.
Rev. W. B. Raber	Mechanicsburg, Pa	Bolton gray fowls.
Lunatic Asylum	New Jersey	Sweet corn.
E. P. Vaux	Washington, D. C	Arctic dog.
George Clark	Detroit, Mich	Varieties of northern lake fish.
Linton Usher	Washington, D. C	Fish from Hayti.
William Fletcher	Chelmsford, Mass	Corn.
Dr. Habel	St. Salvador	Specimen from silk cotton tree, (Bombax.)
John Merritt, jr	Farmingdale, N. Y	Walnuts; acorns; fibres, &c.
N. W. Schoonhoven	Elgin, Ill	Merino wool.
J. R. Dodge, (Dep't of Agriculture.)	Washington, D. C	Petroleum shales.
S. J. Merriam	Brandon, Vt	Box of merino wools.
N. A. Child	Temple, N. H	Maple sugar in cakes.
Samuel Yewdall	Philadelphia	Woollen yarns, plain and colored.
J. C. Heritage	Milton, Wis	Sorghum sugar and sirup.
J. I. Rosenburg	Lansing, Minn	Wool, five specimens.
C. S. Ells	Davenport, Iowa	Specimen of wools.
H. U. Soper	Batavia, N. Y	Leather tanned in six days, by Union tan process.
N. H. Daggett	Attleboro', Mass	Leicester wools, braids, and letter.
Mr. Olmstead	Washington, D. C	Lignite.
C. W. Wandell	Beaver, Utah	Argentiferous galena; silver ore.
G. M. Turner	California	Photograph of fifty pears on one stalk.
M. Angelica	St. Elizabeth's Asylum, N. O.	Silk manufactured and dyed.
F. W. Lee	Stonersville, Pa	Southdown wool.
H. S. Harris	Massachusetts	Gold from near Fort Smith, Va.

DONATIONS TO AGRICULTURAL MUSEUM—Continued.

Name.	Residence.	Articles.
R. B. Miller	Utica, N. Y	Epilobium fibre; sock and sample of yarn.
A. B. Goss	Lower Waterford, Vt	Copper ore.
A. G. Boone	Booneville, Colorado Ter.	Wool, full Spanish; half-bred Mexican.
John Varcoe	Wayne county, Pa	Wool, Cotswold.
M. Riley	Washington, D. C	Ball of twine of Manilla paper.
H. G. Piper	Hinckley, Ohio	Petroleum, crude.
Elder J. Bell	Washington, D. C	Large horn.
Jacob Barton	Little Meadows, Pa	Dutton corn, &c.
N. R. Helper	Consul, Buenos Ayres	Alpacca wool from Bolivia.
A. L. Siler	Northup, Utah Ter	California quail's eggs.
Com. L. M. Powell	Sag Harbor, L. I	Sea island grass for fibre.
B. K. Tully	Russelville, Ky	Cashmere goat's wool; samples of cloth made from same.
State Department	Washington, D. C	Antigua cotton.
E. Remington	Williamsport, Pa	Skin of whippoorwill.
L. H. Rassney	Washington, D. C	Eggs and moth of hop-vine insect
Andrew Tate	Bayfield, Wis	Specimen of flax and timothy grass.
E. M. McConnell	Newcastle, Pa	Prunes.

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